Distribution and Abundance of Macrobenthic Infauna from the Continental Shelf off Southwestern Vancouver Island, British Columbia

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1987

Canadian Technical Report of Hydrography and Ocean Sciences No. 85

87-04814/

Canadian Technical Report of Hydrography and Ocean Sciences

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DISTRIBUTION AND ABUNDANCE OF MACROBENTHIC INFAUNA FROM THE CONTINENTAL SHELF OFF SOUTHWESTERN VANCOUVER ISLAND, BRITISH COLUMBIA

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Cat. No. 0711-6764 FS-97-18/85

Catalogue no. FS-97-18/85 ISSN 0711-6764

Correct citation for this publication:

Brinkhurst, R.O. (ed.) 1987. Distribution and abundance of macroscopic benthic infauna from the continental shelf off southwestern Vancouver Island, British Columbia, Canada. Can. Tech. Rep. Hydrogr. Ocean Sci. No. 85:86p.

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ABSTRACT

Brinkhurst, R.O. (ed.). 1987. Distribution and abundance of macroscopic benthic infauna from the continental shelf off southwestern Vancouver Island, British Columbia, Canada. Can. Tech. Rep. Hydrogr. Ocean Sci. No. 85 :86p.

The soft sediment macrofauna and corresponding sediment characteristics of the shelf area off the southwestern side of Vancouver Island, B.C. were examined in detail. Two distinct species assemblages were identified, a "silt/clay" assemblage characterized by relatively high organic carbon and percent silt/clay in the sediment, and a "sand" assemblage characterized by low silt/clay and organic carbon in the sediment. It was concluded that sediment particle size and organic content were the principle factors affecting species composition, whereas proximity of stations was the important factor affecting species composition within a given sediment type. Species compositions and abundances were similar for both cruises. Number of species (102-178) and abundance (808-2860/0.5m^2) were not noticeably different in sandy vs silt/clay stations, and were considered high compared to similar studies in the Northeastern Pacific. This is partly due to the small sieve size used for sampling during the current study.

The original hypothesis that benthic faunal composition could be predicted by primary productivity and current characteristics of overlying waters, was not supported by this study.

Keywords: Benthos, benthic faunal survey, shelf, sediment

RÉSUMÉ

Brinkhurst, R.O. (ed.). 1987. Distribution and abundance of macroscopic benthic infauna from the continental shelf off southwestern Vancouver Island, British Columbia, Canada. Can. Tech. Rep. Hydrogr. Ocean Sci. No. 85:86p.

On a effectué un exame détaillé de la macrofaune peuplant les sédiments mous et des caractéristiques sédimentaires correspondantes de la plate-forme située au large de la côte sud-ouest de l'ile de Vancouver (C.-B.). Deux groupements spécifiques différents ont été identifiés: un groupement "limon/argile" caractérisé par des teneurs et un pourcentage relativement élevés de carbone organique et de limon/argile respectivement et un groupement "sable" caractérisé par des faibles teneurs et pourcentage de carbone organique et de limon/argile respectivement. L'auteur en conclut que la taille des particules sédimentaires et la teneur en matières organiques sont les principaux facteurs influant sur la composition spécifique tandis que la proximité des stations est le facteur majeur influant sur la composition spécifique á l'intérieur d'un type de sediment donné. Au cours des deux expéditions, la composition et l'abondance spécifiques se sont révélées semblables. Le nombre d'espèces (102-178) et l'abondance (808-2,860/0,5m^2) n'étaient pas sensiblement différents aux stations en milieu sablonneux par rapport aux stations en milieu limon/argile; ils sont toutefois considérés éléves par rapport aux résultats d'autres études semblables menées dans le Pacifique nord-est. Occi est en partie le résultat du fin maillage du tamis utilisé pour l'échantillonnage effectué dans le cadre de la présente étude.

L'hypothèse initiale, soit que la composition de la faune benthique peut être prédite par la productivité primair et les caractéristiques actuelles des eaux sus-jacentes, n'a pas été étayée par la présente étude.

Mots Clés: benthos, relevé de la faune benthique, plate-forme, sédiment

PREFACE

The initial impetus for this study, funded by the Unsolicited Proposal programme of Supply and Services Canada, was to familiarize proponents with offshore marine benthic sampling methods and the fauna of (primarily) muddy substrates in an area utilised by groundfish fishermen and potentially subject to exploration for hydrocarbons. Two environmental factors were considered at the outset, an apparent separation of two very productive areas by a less productive area, for plankton, and a seasonal development of oxygen depletion in the water column of another area on the shelf off Barkley Sound. Samples were also broken down into 6 or 9 separate cores plus the residue to determine spatial distribution patterns within samples, which led to severely increased logistical problems with samples. The objective of minimising substrate variability in order to investigate the other factors noted was compromised by the absence of muddy substrates under the outermost high plankton production zone.

Considerable efforts have been made to obtain the best available taxonomic expertise and careful attention was paid to quantitative sampling. This study should therefore provide a foundation for future work in the area, and a basis for comparison with other studies.

INTRODUCTION

This report documents the identity and relative abundance of the macrobenthos of locations off the southwest coast of Vancouver Island, British Columbia. The report also contains information on some associated sediment variables. Identifications are now available for all of the major taxa, and for a number of small groups. Others remain unidentified because of lack of available experts or poor condition of material (see Table 1).

The study provides benthic faunal information for an area previously unstudied in any detail, as well as complementing oceanographic and sediment character studies of the area performed by personnel at the Institute of Ocean Sciences.

The stations sampled fell into several groups based on predicted productivity factors from oceanographic studies. Denman et al. (1981), Freeland and Denman (1982) and Mackas et al. (1980) have summarized the principal oceanographic factors responsible for maintaining two broad fronts of high primary production over the open continental shelf in the study area. The mechanism involves two water bodies: a) a seaward moving mass of estuarine water from the Juan de Fuca Strait, and b) the California Undercurrent. These two water bodies and the submarine topography of the shelf interact in the following manner. The low oxygen, nutrient-rich California Undercurrent is deflected along the continental margin, particularly in the region of the Juan de Fuca Canyon. This upward moving water is entrained into the seaward moving estuarine waters from Juan de Fuca Strait in the southeast corner of Vancouver Island. This is also a region of high tidal mixing. This entrained, high-nutrient source moves alongshore, in a band some 65 km long and approximately 20 km wide. This constant supply of nutrients in the summer months contributes to the maintenance of primary production at the inshore front adjacent to Amphitrite Point. Sample stations in areas A and B mostly fall under this front. Stations in area C are supposed to lie in the area outside the stimulating effect of the estuarine flow.

The California Undercurrent abuts the shelf along its entire margin. This produces a weak upwelling, supplying nutrients to the surface water in the vicinity of outer canyons like Nitinat. This weak upwelling is responsible for maintaining the offshore front which parallels the 80 m contour some 35 km offshore. Stations visited in area D were supposed to fall within the influence of this front, and to be located over muddy substrates.

The temporal basis of the study related to the intrusion of low-oxygen water over the shelf in the vicinity of Nitinat Trough (Hill et al. 1982a, b). Near-bottom oxygen levels can be below 1.5 mL/L for several weeks. Cruise 1 took place soon after the intrusion was thought to begin. Cruise 2 was timed so that the intrusion had been in existence for the summer.

The hypothesis was that the four areas would cluster in a pattern predictable by oceanographic features such as water mass movement and

primary productivity, and so variation in sediment texture and composition were avoided. The absence of muddy substrates in area D compromised this effort, but provided an opportunity to examine the relationship between the benthic fauna and the substrate.

PROJECT HISTORY

The study design was used as the basis of an Unsolicited Proposal submission to Supply and Services Canada who, in cooperation with the Institute of Ocean Sciences (IOS), funded the project. Dobrocky Seatech Limited carried out the bulk of the sampling, sorting and identification of the major invertebrate groups, as well as the sediment analyses. Draft reports on the chemical and physical data and part of the biological data were prepared by the company as unpublished documents, which are located at the Institute of Ocean Sciences pending completion of several aspects of the work. These reports will be referred to as O'Connell et al. 1983 a and b throughout this document.

The second phase of the study involved the submission of the reference collection of representative specimens of all the taxa identified by Dobrocky Seatech Limited staff to a variety of taxonomic specialists. Much of this work was undertaken by E.V.S. Consultants Ltd. and their sub-contractors. All specimens of those groups of animals that had not been investigated by Dobrocky Seatech Limited staff were also sent to appropriate authorities, as were all of the specimens from 6 stations located in areas of sandy substrates. Much of this work was carried out by the Ocean Ecology Division of IOS. Specimens which were identifiable (some were not, usually because the specific preservation means required were not feasible in this study) and those individuals that identified them are listed in Table 1.

In the third phase of the study the information recorded in O'Connell et al. (op. cit.) was reordered, corrected and extended by additional information on six stations from cruise two which were not included in the original report. The most significant tasks of this phase included the revision of the species list and condensation of species density data from counts per sample core (either six or nine), remaining sediment and pore water, to total counts per grab. During this process, the verifications and most of the final identifications were obtained (by March 1986) and the original species distribution lists revised. Taxonomic lists followed the sequence and names used by Parker (1982) and Austin (1985).

The fourth and final phase of the study involved revision of the data set to include new identifications of gammarid amphipods from 6 sandy substrate stations from Cruise 2, and reduction of the species abundance data matrices from Cruises 1 and 2 for non-parametric statistical analysis. Because of all the subsequent amendments and additions to the text and data of the draft reports, most of the extensive multivariate statistical analyses performed by Dobrocky Seatech Limited are no longer usable and will not be reported here.

The bulk of the collection of animals reported in this study is stored at the National Museum of Natural History in Ottawa, and some decapods, echinoderms and fish are deposited at the British Columbia Provincial Museum.

Table 1. Authorities responsible for identification and verification of benthic organisms Phase I: initial sorting and identification by Dobrocky Seatech Ltd. Phase II: Identification and verification by specialists in particular taxonomic groups.

Taxon	Identifier Phase I	Identifier/Verifier Phase II	Remarks
Foraminiferida	R. Littlepage	N.A	
Porifera	N.A.	W.C. Austin	Specimens unidentifiable
Cnidaria	N.A.	W.C. Austin	
Platyhelminthes	N.A.	W.C. Austin	Specimens unidentifiable
Nemertea	N.A.	R. Gibson	Specimens of poor quality
Kinorhyncha	N.A.	W.C. Austin	
Nemata	N.A.	D. Hope	Mostly unidentifiable
Aplacophora	N.A.	A.H. Scheltema	
Gastropoda	J. Watson	R.G.B. Reid, R. Shimek (Turridae)	for Cruise 2 only
Cephalopoda	N.A.	W.C. Austin	
Scaphopoda	N.A.	R. Shimek	I.D.'s for Cruise 2 only
Bivalvia	P.Gee G.W. O'Connell	R.G.B. Reid	
Polychaeta	S.C. Byers M. Bracken G.S. Calderwood	E. Ruff, H. Jones	
Oligochaeta	N.A.	C. Erseus	I.D.'s for Cruise 2 only
Echiura	N.A.	W.C. Austin	Mostly unidentifiable
Bryozoa	N.A.	W.C. Austin	
Brachiopoda	N.A.	W.C. Austin	
Sipuncula	N.A.	P. Frank	Specimens of poor quality
Ostracoda	N.A.	B. Cameron	Specimens of poor quality
Harpacticoida	E.P. Anderson	P.A. Montagna	Specimens of poor quality
Cyclopoida	N.A.	G. Heron	Specimens of poor quality
Calanoida	N.A.	C.C. Davis W.C. Austin	Specimens of poor quality
Cumacea	G.W. O'Connell	N.S. Jones	Two new species
Tanaidacea	N.A.	I. Williams	
Isopoda	N.A.	G. Wilson	Several new species
Amphipoda	G.W. O'Connell P. Shaw	C. Staude	
Euphausiacea	N.A.	R.D Kathman W.C. Austin	
Decapoda	N.A.	P. Lambert	
Bryozoa	N.A.	W.C. Austin	
Brachiopoda	N.A.	W.C. Austin	
Chaetognatha	N.A.	A. Alvarino	Specimens unidentifiable
Ophiuroids	C. Rendell	W.C. Austin	
Other Echinoderms	C. Rendell	P. Lambert	
Fishes	R. Kashino	A.E. Peden	

METHODS

STUDY LOCATION AND SAMPLES OBTAINED

The location of stations occupied and the list of samples achieved relevent to this report are shown in Tables 2 and 3 and Figure 1.

SEDIMENT SAMPLES

Sediment samples were removed from that part of each Smith-McIntyre grab sample beside the area used for 6 to 9 cores (Figure 2). Samples destined for analysis of particle size, chlorophyll-a and phaeopigment were removed from the top centimeter of the grab with a plastic trowel and stored frozen in whirl pack bags. Samples for carbon-hydrogen-nitrogen (CHN) and total organic carbon (TOC) analyses were obtained with an acetone-rinsed stainless steel trowel, placed in pre-combusted (500 C) aluminum containers, and frozen within 30 minutes of collection.

Sediment particle size distributions were analyzed with the Model 5000D Micromeritics sedigraph and the 2m settling tube at the Pacific Geoscience Centre. Each sediment sample was divided into two fractions by wet-sieving on a 63um mesh. The fine fraction (silts and clays) that passed through this mesh were analyzed on the sedigraph. The coarse fraction (sands) retained by the mesh were analyzed in the settling tube.

The fine fraction was centrifuged for 40 minutes at 2000 RPM, decanted into containers, then freeze-dried for 2-3 days until dry and flaky. Two-gram samples of freeze-dried sediment were sonified, then put into the sedigraph. The sedigraph plotted results on an X-Y chart recorder as cumulative mass per cent versus equivalent spherical diameter (range: 63 - 0.1 um).

The coarse fraction was oven-dried at 100 C, then dry-sieved to remove excess fines. Two-gram samples of sand were placed into the top of the settling column, and settled in a collecting pan at the bottom. A strain gauge at the collecting pan transmitted an analog signal to an X-Y plotter, which recorded the accumulation of sand on the pan over time.

The X-Y plots from the sedigraph and settling tube analyses were digitized on a high-resolution digitizing table. Sedigraph traces were digitized at 0.25mm intervals, which recovered 900 points from each X-Y trace. Settling tube traces were digitized at 0.5mm intervals, recovering a similar number of points.

Personnel at Dobrocky Seatech Limited modified the program SIZEBAL of Thiede et al. (1976) to recover the information from the digitized records. This program generated a composite plot from the particle size information in a settling tube or sedigraph trace. The program plotted both a cumulative mass percent and a frequency curve for each sample. Cumulative curves were smoothed by a three-point moving average function, while frequency curves were smoothed by a five-point moving average (O'Connell et al. 1983a).

Table 2. Stations occupied during Cruise 1 (30 April-7 May 1981) and Cruise 2 (14-17 September 1981).

	Cruise 1			Cruise 2		
Station	Latitude oN	Longitude oW	Depth, metres	Latitude oN	Longitude oW	Depth, metres
A1	48o47.0"	125o29.0"	107	48o47.0"	125o29.0"	107
A2	48o45.3"	125o33.9"	145	48o46.0"	125o34.4"	151
A4	48o44.2"	125o29.4"	122-25	48o44.2"	125o29.4"	120-24
A5	48o41.0"	125o32.1"	175	48o41.0"	125o32.1"	197
B1	48o38.3"	125o16.5"	106-07	48o33.3"	125o16.5"	109
B2	48o35.5"	125o16.6"	119	48o35.5"	125o16.5"	120.
B3	48o35.5"	125o24.4"	133	48o36.1"	125o24.5"	126-28
B4				48o36.5"	125o35.0"	109
C1	48o30.8"	125o19.3"	142	48o30.9"	125o19.1"	142
C2	48o26.1"	125o22.0"	162-64	48o26.1"	125o22.0"	173
C4	48o23.8"	125o35.8"	133	48o23.8"	125o35.8"	133
C5				48o21.2"	135o38.2"	140-42
D1	48o37.0"	126o00.8"	111	48o37.0"	126o00.8"	115
D2	48o43.1"	126o05.0"	114	48o43.1"	126o05.0"	118
D3	48o40.9"	126o02.8"	111	48o40.9"	126o02.8"	118
D4				48o46.1"	126o07.1"	115

Table 3a. Types and numbers of benthic samples taken during Cruise 1 (30 Apr-7 May 1981).

Station	Date	Grab samples		Sled samples	Trawl samples	Photographs
		Infaunal subcores	Sediment subcores			
A1	5 May	9	3	1	1	2
A2	5 May	9	3	1	0	10
A4	5 May	9	3	1	0	10
A5	5 May	9	3	0	1	0
B1	4 May	9	3	1	0	0
B2	4 May	9	3	1	0	0
B3	4 May	9	3	1	0	16
C1	2 May	9	3	1	0	12
C2	2 May	9	3	1	0	10
C4	3 May	6	3	1	1	0
D1	7 May	9	2 or 3	0	1	14
D2	7 May	6	3	0	1	12
D3	7 May	6	2	0	0	0

Table 3b. Types and numbers of benthic samples taken during Cruise 2 (14-17 September 1981).

Station	Date	Grab samples		Sled samples	Trawl samples	Photographs
		Infaunal subcores	Sediment subcores			
A1	14 Sep	9	3	1	0	2
A2	14 Sep	9	3	1	0	12
A4	14 Sep	9	3	0	0	2
A5	14 Sep	9	3	1	0	8
B1	16 Sep	9	3	1	0	0
B2	16 Sep	9	3	1	0	18
B3	16 Sep	9	3	1	0	0
B4	16 Sep	9	3	1	0	0
C1	17 Sep	9	3	1	0	0
C2	17 Sep	9	3	1	0	0
C4	17 Sep	6	2	0	1	3
C5A	17 Sep	9	3	0	1	7
C5B	17 Sep	6	2	-	-	-
D1	15 Sep	6	2	0	1	12
D2	15 Sep	6	2	0	1	13
D3	15 Sep	6	2	0	1	4
D4	15 Sep	6	2	0	1	10

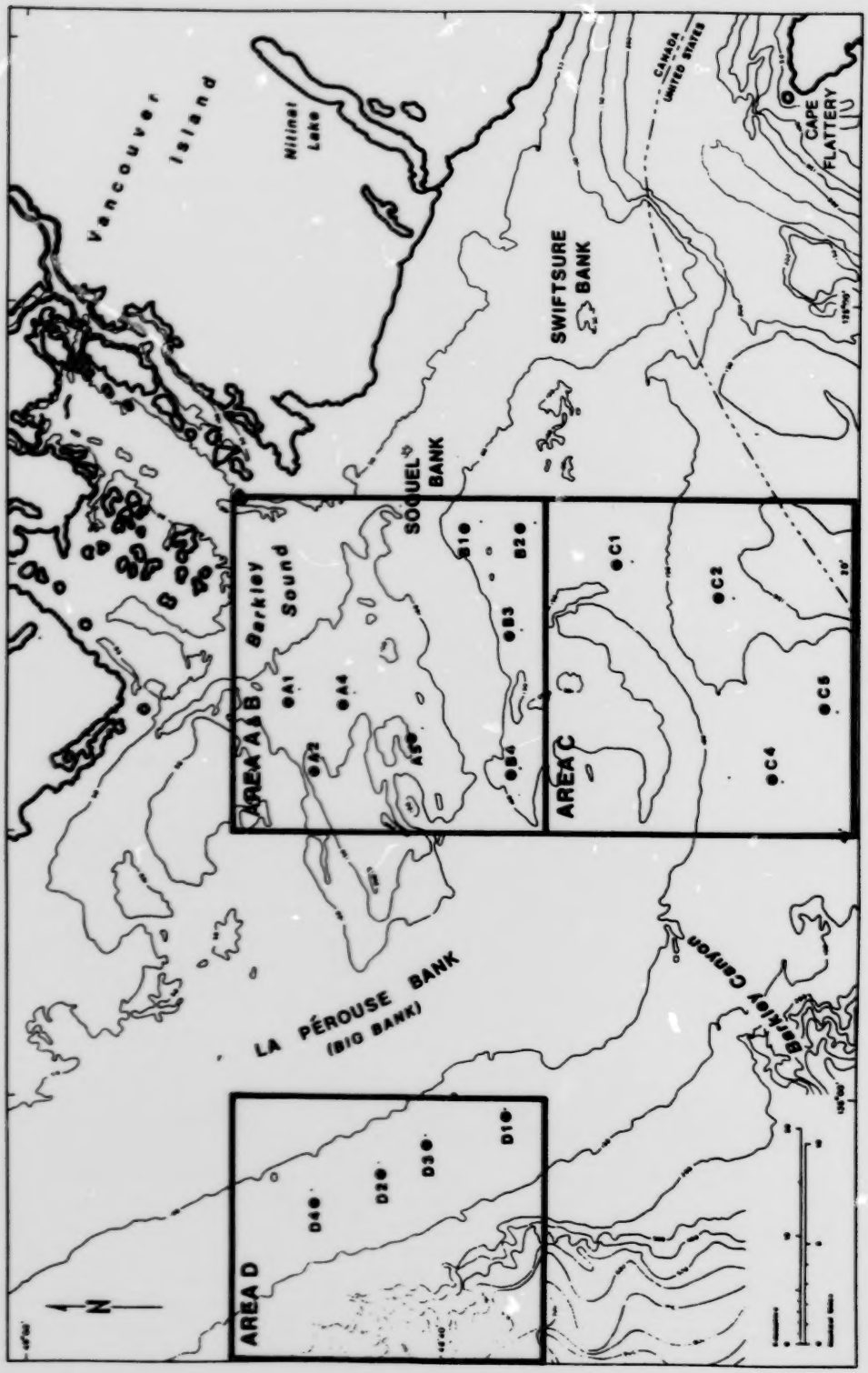


Figure 1. Study areas showing sampling stations.

Samples for total carbon and nitrogen in surficial marine sediment samples were oven-dried at 105 C for 24 to 36 hours, then pulverized. Small aliquots (0.5 to 0.6 mg) of dried sediment were weighed in tin sample containers on a Mettler ME30 microbalance.

Sediments were analyzed with a Carlo-Erba Model 1106 elemental analyzer in batches of about 40 samples. In each batch, three samples of N-acetyl-D-glucosamine (NAG) and three empty tin cups were included as controls.

The chlorophyll-*a* and phaeopigment content of sediments was measured by the methods of Hargrave and Phillips (1981) and Propp *et al*. (1980). A 1.0mL aliquot of sediment was taken from each sample and agitated in a small volume of 90% acetone. The sediment-acetone mixture was allowed to sit approximately 2 hours in the dark, then the supernatant and several washes were filtered through a glass fibre filter. More 90% acetone was added to the supernatant to increase the volume to about 10 mL. After acidification with 17 mM HCl, chlorophyll-*a* and phaeopigment concentrations were measured with a Turner Model III fluorometer, after the method of Holme-Hansen *et al*. (1965). The fluorometer was calibrated with a spectrophotometrically analyzed standard of unialgal phytoplankton culture. Pigment concentrations were reported in mg per L of sediment.

BENTHIC SAMPLES

The quantitative benthic samples were obtained with a 0.27m^2 Smith-McIntyre grab. As soon as the grab was on deck, the supernatant water was removed with a hand pump. The water was sieved (0.25 mm) and the organisms were preserved (10% seawater-buffered formalin with Rose Bengal). These subsamples were referred to as the "water samples" by O'Connell *et al*. (1983b). Cylindrical cores (83 cm^2 x15 cm deep) were then removed from the grab in a 3 x 3 pattern (Figure 2). The initial plan was to obtain 9 cores per grab but only 6 cores could be obtained from most samples in sandy substrates (Table 3). These subcores represented about 15-20% of the total sediment volume. These samples were screened and preserved in the same way, and were labelled "subcore samples". The rest of the sample, apart from a small quantity used for the determination of sediment characteristics, was then screened at 1 mm and the residue preserved as before and referred to as the "macro" sample.

Qualitative estimates of the epifauna were obtained using an epibenthic sled (130 cm beam, 2 mm Nitex mesh) over mud and an Agassiz trawl (183 cm beam, 38 mm mesh) over sand. The contents of the trawls were first hand-picked and then screened (2 mm mesh) and preserved.

In the laboratory, preliminary sorting of samples into Mollusca, Polychaeta, Crustacea, Echinodermata and Varia was done using x40 dissecting microscopes. Samples from coarse sand were elutriated in a 75 cm diameter Plexiglass column with controlled water flow from the bottom to an upper overflow channel drained through a 0.25 mm screen. Each 500 mL of sand was elutriated for about 90 minutes. All sorting was checked by having a proportion of the sample residues repicked by alternate sorters.

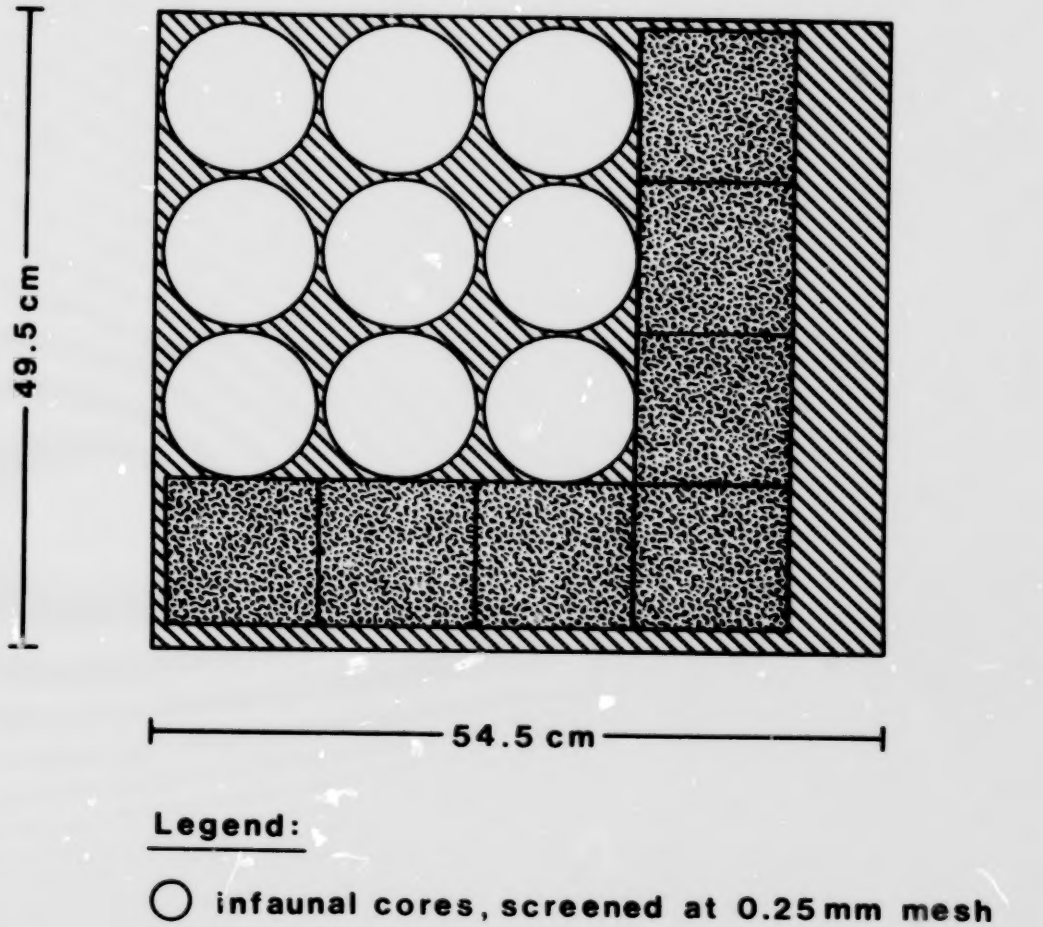

49.5 cm
54.5 cm
Legend:
infaunal cores, screened at 0.25 mm mesh
"macro" samples, screened at 1.0 mm mesh
areas used for sediment chemistry analysis

FIGURE 2. Placement of subcore samples within the 0.27 m^2 Smith-McIntyre grab. Measurements are in centimetres.

Specimens were labelled with a code representing Cruise (1 or 2), area (A to D), station (1 to 5 in the four areas), sample replicate (A or B) and (where relevant) subcore number (1 to 6 or 1 to 9). Full labels would then appear as 2B3B7 for Cruise 2, area B, station 3, replicate B, subcore 7.

The specimens belonging to the major groups were then identified by Dobrocky Seatech staff and associates (Phase I, Table 1). Representative specimens of taxa identified in Phase I and all remaining taxa and whole samples were then submitted to a number of authorities for verification and/or identification (see Phase 2, Table 1). However, several samples from Cruise 2 (B4, C5, D1-4) were identified by taxonomic authorities only.

BIOMASS

All individuals from one randomly selected subcore from each grab were ashed, but no attempt was made to separate out rare, larger organisms which individually might make up a large percent of the biomass of a sample. A second randomly selected core was used to separate the polychaetes into guilds, and the 5 or 6 most abundant of these were ashed separately, as were molluscs, crustaceans and varia (all other taxa). Organic weight was considered to be ash-free dry weight.

STATISTICAL ANALYSIS OF BENTHIC DATA

Several multivariate statistical methods were employed by O'Connell et al. (1983a) in an attempt to parallel the work of Lie (1969), Lie and Kisker (1970) and Lie and Kelley (1970). Few of these are reported here, largely because of changes to the data matrices and high within-grab errors (between subcores) which became evident during data analysis.

Species abundance data matrices were constructed for two replicates of 13 stations for each of the two Cruises. In Cruise 1, only one replicate was taken at station C4, so the data were duplicated to produce a matrix symmetrical with that for Cruise 1. All taxa from the "water", macro and subcore samples were included. The following data were excluded from the abundance matrices:

a) numbers of damaged organisms
b) specimens unidentifiable by Dobrocky Seatech staff (see Table 1)
c) data from Cruise 2 sample sites not visited during Cruise 1 (2B4, 2C5, 2D4)
d) Ostracods (totals), since these were never counted for 2D1-2D3. Identifications were done on a small number of Ostracods from all stations in Cruise 2 and these taxa are included in Appendix 1.

Species which occurred in less than ten percent of the sample sites in both cruises and had less than 5 individuals in any replicate were arbitrarily rolled up into taxonomic groups (i.e. "Other Polychaeta", etc.) to reduce the matrix size to a manageable level. Species present in greater than 10% of samples in only one of the cruises were included in the data matrix of the other cruise. The aforementioned modifications produced two data matrices of symmetrical proportions with 26 replicates and a total of 338 matched species.

The data matrices generated from the two cruises were analysed by average linkage cluster analysis, using weighted pair group mean averaging (WPGMA) (Sneath and Sokal 1973) and the complement of the Bray-Curtis similarity coefficient. This "dissimilarity" coefficient indicates the degree of relative difference in overall species composition and abundance between stations, scaled between 0 and 1. Therefore a dissimilarity close to 1 indicates that two stations are very different relative to all the other stations. Stations or clusters of stations are linked together at the appropriate distances from each other (average dissimilarity). The significance of each linkage was tested using a "bootstrap" method (Nemec and Brinkhurst - in prep, Diaconis and Efron 1983, Felsenstein 1985). A "p" value of less than 10% was considered to represent a significant ordering of stations at a given linkage level. The dissimilarity between replicates of each station was analysed separately using the complement of the Bray-Curtis coefficient.

The dendrogram generated from each abundance data dissimilarity matrix was then qualitatively compared with preconceived dendrograms generated from dissimilarity matrices based on (1) geographic distances between stations; (2) difference in mean sediment particle size between stations; (3) difference in mean carbon content of sediments for different stations; (4) difference in mean chlorophyl a content of sediments for different stations. Finally, the abundance matrices of the two cruises were compared using a bootstrap method (Nemec and Brinkhurst in prep), to test the null hypothesis (Ho) that the two matrices were the same. The comparison tested the null hypothesis at each linkage level (non-cumulative). A "p" value <0.1 would result in rejection of the null hypothesis at each linkage level.

RESULTS

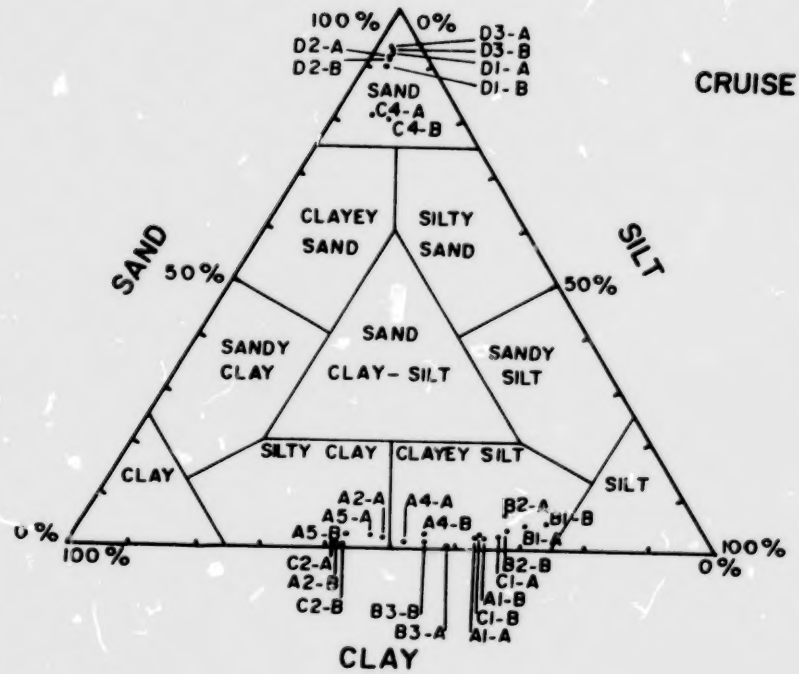
PARTICLE SIZE CHARACTERISTICS

Table 4 shows the results of the particle size analyses on 58 grab samples taken during Cruises 1 and 2. Each number in this table represents the mean of two or three subsamples taken from each grab. In general, the table shows that bottom substrates in areas A and B are relatively homogeneous, and are mostly very fine to medium silts. Area C is heterogeneous, as substrate textures vary from very fine silts to medium sand, depending on location. Substrate textures in Area D are again relatively homogeneous although courser than the other areas, and consist mainly of find sand. In summary, areas A and B represent one type of sediment, area D represents a different type of sediment, while area C represents a mixture or intermediate between these two. Figure 3 illustrates this general description in graphic form.

Results from samples taken during Cruise 2 are very similar to those taken during Cruise 1, except for area A5. This station was the deepest sampled in Cruise 2 (20m deeper than in the first cruise) and had a higher sand content than in the first cruise.

Table 4. Mean particle size distribution of shelf sediments. Sediment descriptions follow the Wentworth classification system.

Station	Particle size distribution						Sediment description	
	% sand		% silt		% clay			
	Cr. 1	Cr. 2	Cr. 1	Cr. 2	Cr. 1	Cr. 2	Cr. 1	Cr. 2
A1-A	2.07	3.03	61.3	60.18	36.62	36.78	Fine silt	Fine silt
A1-B	2.18	2.59	62.8	53.38	35.02	44.02	Fine silt	Fine silt
A2-A	1.93	0.98	46.26	39.7	51.8	59.32	Fine silt	VFine silt
A2-B	0.6	0.73	40.02	38.99	59.37	60.28	VFine silt	VFine silt
A4-A	1.37	2.3	50.31	48.25	48.31	49.44	Fine silt	Fine silt
A4-B	2.04	3.09	52.9	47.6	45.05	49.3	Fine silt	Fine silt
A5-A	2.35	23.88	44.58	30.76	53.05	45.35	Fine silt	Medium silt
A5-B	2.55	46.76	40.35	21.91	57.09	31.32	VFine silt	Coarse silt
B1-A	4.37	6.5	67.43	57.12	28.18	36.37	Medium silt	Fine silt
B1-B	5.8	8	70.88	59.68	23.31	32.31	Medium silt	Fine silt
B2-A	6.26	0.95	63.75	57.58	29.98	41.47	Fine silt	Fine silt
B2-B	3.24	1.66	65.15	55.45	31.61	42.88	Fine silt	Fine silt
B3-A	0.34	1.04	57.87	55.21	41.78	43.73	Fine silt	Fine silt
B3-B	1.51	1.68	53.31	56.69	45.17	41.62	Fine silt	Fine silt
B4-A		1.66		47.08		51.25		VFine silt
B4-B		2.38		48.68		48.93		VFine silt
C1-A	2.65	4.09	64.18	55.43	33.16	40.48	Fine silt	Fine silt
C1-B	2.04	7.35	61.39	53.15	36.57	39.49	Fine silt	Fine silt
C2-A	0.51	1.15	39.39	36.24	60.09	62.6	VFine silt	VFine silt
C2-B	0.43	1.34	41.21	39.17	58.34	59.49	VFine silt	VFine silt
C4-A	81.12	84.35	4.95	6.1	13.92	9.54	Fine sand	Fine silt
C4-B	81.06	91.2	7.19	3.32	11.74	5.47	Fine sand	Med. sand
C5-A		89		4.27		7.1		Fine sand
C5-B		92.7		2.76		4.53		Fine sand
D1-A	92.74	91.45	2.23	3.01	5.02	5.53	Fine sand	Fine sand
D1-B	90.27	93.71	2.84	1.85	6.89	4.43	Fine sand	Fine sand
D2-A	92.05	95	2.69	2.14	5.25	4.44	Fine sand	Fine sand
D2-B	91.76	92.41	2.68	2.68	5.55	4.9	Fine sand	Fine sand
D3-A	93.64	91.34	1.89	2.72	4.47	5.94	Fine sand	Fine sand
D3-B	93.48	93.67	1.84	2.25	4.67	4.07	Fine sand	Fine sand
D4-A		89.9		3.47		6.62		Fine sand
D4-B		89.29		3.81		6.89		VFine sand



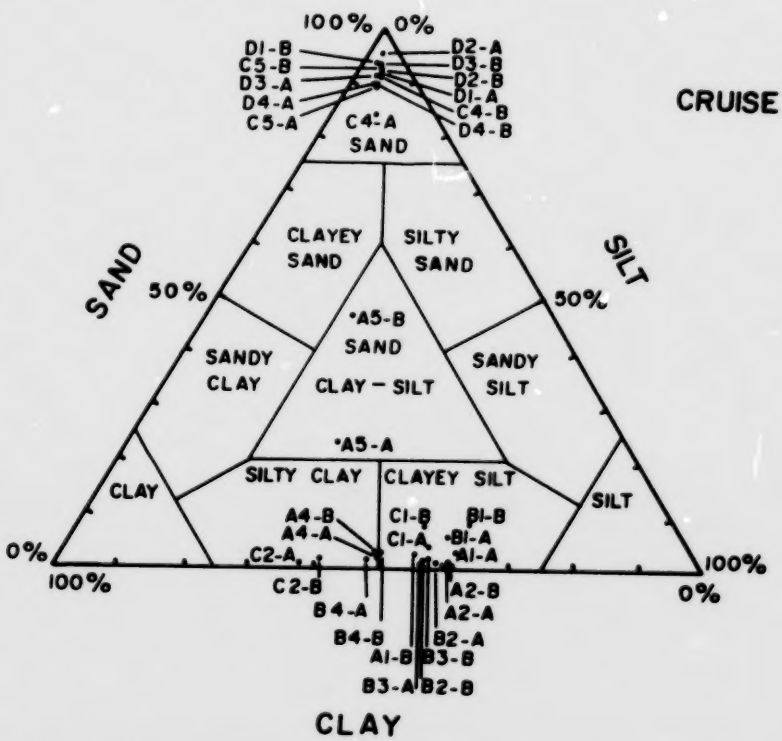


FIGURE 3. Shepard's triangle of sediment components, Cruises 1 and 2.

SEDIMENT CHEMISTRY

The interpretation of sediment chemistry results (Tables 5,6) is affected by high within-sample errors in chlorophyll-a, phaeopigments and nitrogen (O'Connell et al. 1983a). A three way nested ANOVA was performed by Dobrocky Seatech Limited to determine any differences in pigments between different stations or between the two cruises. They found that the largest source of variance was between replicates within grab samples. D. Mackas (Institute of Ocean Sciences - personal communication) suggested that variation in percent pore water between subcores could be the cause of this high variation. Nitrogen values were also highly variable within subcores. However, the analyses of O'Connell et al. (1983a) did show that carbon values had a much lower variance within grab samples (7%), with the highest variance ocurring between stations (74%). C/N ratios are summarized for the 4 areas and the two cruises (Table 6).

The outstanding finding from this data is that Area D and C4 sediments had less organic content than A1-C2. This is not surprising, since area D had low silt and clay components. Area A5 in Cruise 2 also had lower organic content in Cruise 2 (sampled from a deeper part of the "hole" or trough) than was measured during Cruise 1.

BENTHOS

All of the taxa identified and verified in this study are listed in Appendix 1. The check list follows each authority listed in Table 1 (or Austin 1985) in terms of nomenclature simply for consistency with a verifiable source. The sequence of taxa follows Parker (1982) from Phylum to Family level. This includes core samples, the uncored portion of the grab samples, and both the epibenthic sled and Agassiz trawl samples. Over 500 taxa are reported from 16 phyla, with the results of analyses of some of the more difficult groups still outstanding (see Table 1). The Polychaeta and Crustacea dominate in terms of the number of taxa (171 and 174 respectively) with the Mollusca accounting for about 100 more. At least 7 new species have been noted, but not yet identified (Cossura, Polychaeta; Diastylis, Leptostylis, Cumacea; Munnopsurus, Caecijaniropsis, Pleurogonium, Isopoda; Orchomene, Amphipoda).

Core Samples

The relative abundances of the species present in each grab sample are presented in Appendices 2 to 4. Since the total grab sample results were grouped for the data analysis of each of the two cruises, and the grab represents an area of 0.27m2 the abundance data (Appendices 2-4) should represent approximate numbers per 1/4m2. The total number of animals per station (for both replicates) is given in Table 7. Total abundances based on the sum of the two replicates, were fairly consistent for each station between May and November. The mean abundance per station was 1870.4 animals per 0.5m2 for Cruise 1 and 1708 per 0.5m2 for Cruise 2.

Some discrepancy in the species abundance data may have resulted from the difference in number of subcores taken in each grab (6 in most sandy substrates, 9 in all others) since the subcores were screened at 0.25mm and the rest at 1mm. Therefore the 9 subcore samples might be expected to have more of the smallest species than the 6 subcore samples.

Table 5. Mean nutrient and pigment concentrations in shelf sediments.

Station	Nutrients (% of total)				Pigment Concentrations (mg.L-1)			
	Carbon		Nitrogen		Chlorophyll a		Phaeopigment	
	Cr.1	Cr.2	Cr.1	Cr.2	Cr.1	Cr.2	Cr.1	Cr.2
A1-A	1.76	1.91	0.22	0.28	0.9	1.37	21.02	46.76
A1-B	1.77	1.91	0.23	0.27	1.09	1.33	22.61	38.03
A2-A	2.13	2.51	0.43	0.35	0.95	0.96	22.33	31.37
A2-B	2.46	2.55	0.31	0.33	1.18	0.86	39.38	20.35
A4-A	2.25	2.3	0.4	0.32	0.72	1.37	18.41	41.58
A4-B	2.14	2.22	0.21	0.32	0.69	1.47	16.41	37.77
A5-A	2.37	2.03	0.26	0.3	0.74	1.27	18.48	31.8
A5-B	2.32	1.51	0.27	0.21	1.11	0.83	25.66	19.03
B1-A	1.44	1.53	0.31	0.23	1.41	1.23	22.55	29.5
B1-B	1.32	1.37	0.29	0.18	1.22	1.55	22.19	23.62
B2-A	1.51	1.93	0.3	0.26	0.78	1.54	20.53	23.02
B2-B	1.78	2.03	0.4	0.27	0.96	1.47	24	29.13
B3-A	2.2	2.05	0.39	0.29	0.61	1.23	15.41	24.8
B3-B	2.02	2.01	0.33	0.31	0.65	0.73	19.44	16.17
B4-A		2.41		0.35		1.1		28.39
B4-B		2.42		0.33		1.84		44.08
C1-A	1.8	1.97	0.26	0.23	0.64		13.42	
C1-B	1.96	1.7	0.15	0.21	0.72	0.77	25.75	21.1
C2-A	2.86	3.21	0.36	0.4	0.69	0.82	16.61	20.28
C2-B	2.98	2.74	0.54	0.34	0.79	0.86	18.44	22.64
C4-A	0.88	1.72	0.16	0.22	0.66	1.01	14.83	42.47
C4-B	0.63	1.22	0.12	0.15	0.96	1.11	26.74	27.41
C5-A		0.59		0.08		0.74		21.09
C5-B		0.34		0.05		0.66		21.12
D1-A	0.34	0.34	0.09	0.11	0.73	1.54	18.44	20.58
D1-B	0.33	0.3	0.07	0.08	0.5	1.35	15.34	16.66
D2-A	0.32	0.36	0.06	0.09	0.57	0.63	15.91	14.8
D2-B	0.32	0.33	0.03	0.06	0.61	0.69	18.69	15.61
D3-A	0.32	0.32	0.03	0.07	0.43	0.87	11.98	15.22
D3-B	0.3	0.29	0.02	0.03	0.47	0.8	14.28	12.45
D4-A		0.3		0.15		0.58		15.9
D4-B		0.58		0.1		0.72		14.6

Table 6. Carbon/Nitrogen ratios summarized for areas A,B,C,D

Cruise	Station	Samples	Mean C(+/-S.D.)	Mean N(+/-S.D.)	C/N ratio
1	A	47	2.15(0.064)	0.296(0.013)	7.26
1	B	36	1.72(0.132)	0.341(0.008)	5.04
1	C	36	1.86(0.824)	0.269(0.053)	6.28
1	D	39	0.33(0.001)	0.057(0.005)	5.79
2	A	60	2.11(0.121)	0.331(0.051)	6.37
2	B	56	1.94(0.143)	0.278(0.005)	6.98
2	C	50	1.71(1.02)	0.216(0.015)	7.92
2	D	51	0.36(0.009)	0.088(0.004)	4.09

Table 7. Species abundance, number of species and dissimilarity between replicates for each station.

Cruise 1

Station	Abundance per 0.5m2	Number of Species	Dissimilarity
A1	2680	162	0.31
A2	2250	140	0.15
A4	2147	150	0.21
A5	2066	130	0.24
B1	2421	169	0.19
B2	1772	140	0.23
B3	1277	124	0.31
C1	808	108	0.26
C2	864	102	0.54
C4	2196	154	
D1	1833	179	0.31
D2	1641	159	0.29
D3	1487	178	0.42

Cruise 2

A1	1777	161	0.26
A2	1362	139	0.37
A4	2266	169	0.23
A5	2860	147	0.27
B1	1779	147	0.25
B2	1622	136	0.35
B3	1750	135	0.23
C1	1956	146	0.24
C2	1383	127	0.27
C4	1721	170	0.36
D1	1470	142	0.36
D2	1619	141	0.32
D3	1137	119	0.42

Appendix 4 data is separated from Appendix 3 because the species identifications were carried out strictly by the taxonomic authorities and not by Dobrocky Seatech Ltd. and their associates (which identifications were only verified by the authorities mentioned). There may therefore be discrepencies in the level of identifications obtained.

Despite these limitations, Appendices 2-4 provide much useful information about the fauna. Sedentariate and errantiate polychaetes dominate the fauna, in both numbers of species and numbers of individuals. The capitellid polychaete Mediomastus ambiseta was the most numerous organism; it ocurred at every station, and sometimes there were hundreds of these animals per grab. Other polychetes which were common at all stations included Myriochele oculata, Prionospio steenstrupi, Cirratulidae indet., Euchymeninae indet. and Aricidea ramosa. Several polychaetes were common in the A1-C2 group only, including Levinsenia gracilis, Cossura soyeri and C. sp. nov., Euchone incolor, Sternaspis scutata, Aricidea lopezi and Nephtys cornutata. Some polychaetes which were common in the C4-D3 group but not in the A1-C2 group included Spionophanes berkleyorum, Glycera capitata, Sphaerosyllis brandhorsti, Chaetozone spp., Tharyx secondus and Notomastus lineatus. There were no oligochaetes found in stations D1-D3 in Cruise 1.

No one species of molluscs was present at all stations. However, the bivalves Axinopsida serricata, Adontorhina cyclia, Yoldia scissurata, Y. thraciaeformis, Macoma elimata and M. carlottensis, as well as the scaphopods Cadulus spp. were present at more than 60% of the stations, usually at densities of less than 50 animals per grab. The bivalves Adontorhina cyclia and Huxleya minuta were comparatively much more common in the D stations than in the A1-C2 group in Cruise 1.

Among the crustaceans, Ostracods were abundant at all stations. The harpacticoids Bradya cf. typica, Typhalamphiacus cf. typhops, and Ectinosomatid sp. B; the cumaceans Eudorella pacifica and Leucon cf. nasica; the tanaids Cryptocope sp. and leptognathiid sp. 2; and the amphipods Harpiniopsis sp., Heterphoxus oculatus (common in A1-C1 stations only) and Ampelisca spp. all ocurred in more than 60% of grab samples, usually at densities less than 30 individuals per grab. The cumacean Lampropos serrata was found in stations C4-D3 only. Euphausiids and decapods were relatively uncommon.

Also ocurring frequently, though generally in densities less than ten individuals per grab, were the brittle stars Amphioplus macraspis, A. strongyloplax and Ophiura sarsi, the heart urchin Brisaster latifrons, and the holothurian Pentamera pseudocalcigera.

In summary, there were several species common to all stations, and a number of species common only in the A1-C2 group or in the D1-D3 group.

Sled and Trawl Samples

Appendix 5 gives the relative abundance of epifaunal organisms that Dobrocky Seatech Limited collected with epibenthic sleds and Agassiz trawls during Cruise 1. Appendix 6 gives similar information for Cruise 2. These appendices are corrected versions of the data appearing in O'Connell

et al. (1983b, Appendix E), in which many of the species were incorrectly identified. Unfortunately, O'Connell et al. (1983a) did not specify the criteria separating one abundance category from another, so that it is difficult to interpret numbers.

Relatively large numbers of the following organisms were taken in sled or trawl samples: scaphopods, especially Cadulus spp.; the gastropods Solariella varicosa, Lunatia pallida, and Nitidella gouldi; the bivalves Yoldia thraciaeformis, Y. scissurata, Macoma carlottensis and Cyclocardia ventricosa; the polychaetes Sternapsis scutata, Pectinaria californiensis, Amphicteis mucronata, A. scaphobranchiata, Pista brevibranchiata, P. cristata and Terebellides stroemi; the decapods Neocrangon communis, N. cf. resima, Pandalus tridens and Eualus avinus; the brittle star Amphioplus strongyloplax; the urchins Allocentrotus fragilis and Brisaster latifrons; and the holothurian Pentamera pseudocalcigera. It is striking that there were almost no polychaetes or bivalves in the sandy station samples, compared with the mud stations.

STATISTICAL ANALYSES

Cluster analyses were first performed on the abundance data as it was presented in O'Connell et al. (1983b). The results were similar to the cluster analyses of the final corrected and expanded data sets presented in this report. The cluster analyses are based on the reduced abundance data for the grab samples only (see Methods). The two data sets contain 26 replicate samples with 338 species each (symmetrical matrices for the two cruises).

Figures 4 and 5 show the results of Q mode cluster analyses using the Bray-Curtis coefficient. The diagrams show dissimilarity between sampling stations, with the significance shown for each linkage (see Nemec and Brinkhurst - in press). Figures 6 and 7 illustrate the clustering of stations at the selected dissimilarity levels of 0.3, 0.4, 0.5 and 0.6. The significance levels from the bootstrap simulations (see Figures 4 and 5) indicate the significance of the order in which the stations are clustered together.

The dissimilarity coefficients between replicates for each station (Table 7) indicate that in all stations but C2, Cruise 1, the replicates were similar. The dissimilarity between the two C2 replicates in Cruise 1 is the result of differences in number of specimens of 5 or 6 species.

The cluster patterns and significances clearly indicate that there are two distinct communities, "A-C1" and "D1-D3", with station C2 distantly clustered with the first group. Station C4 distantly clustered with the second group but was significantly different from the D1-D3 cluster in both cruises. C2 and C4 may represent an area where the two communities meet or overlap.

The preconceived reference trees constructed from geographic distances between stations, difference in chlorophyl-a, sediment particle size and carbon content (linkage trees and levels included in Appendix 7) were compared with the cluster patterns for the abundance data from the two cruises. These "reference" dendrograms indicate:

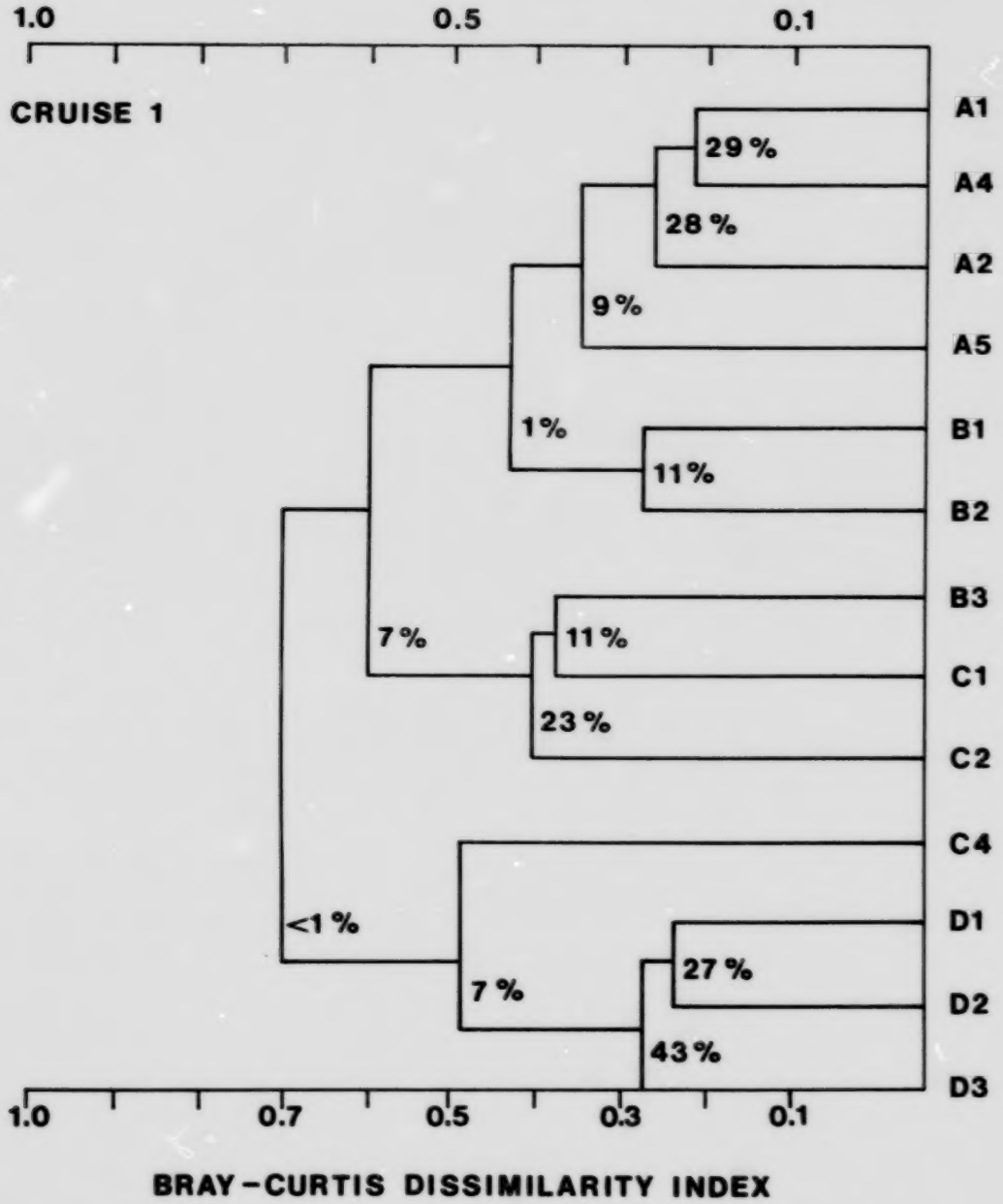


Figure 4. Cluster dendrogram showing dissimilarities in species abundance between stations from cruise 1. Significances (p) of linkages are included.

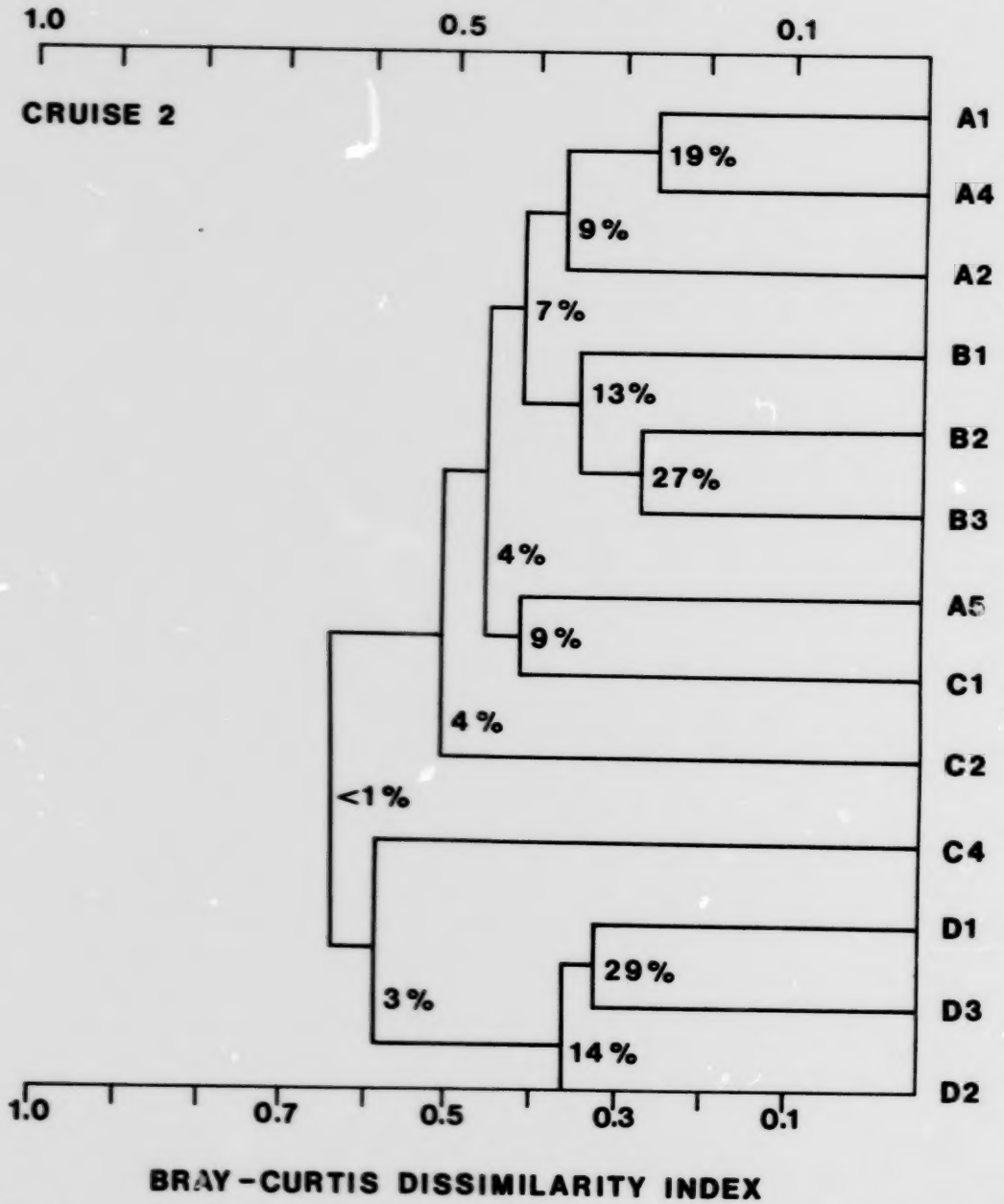


Figure 5. Cluster dendrogram showing dissimilarities in species abundances between stations from cruise 2. Significances (p) of linkages are included.

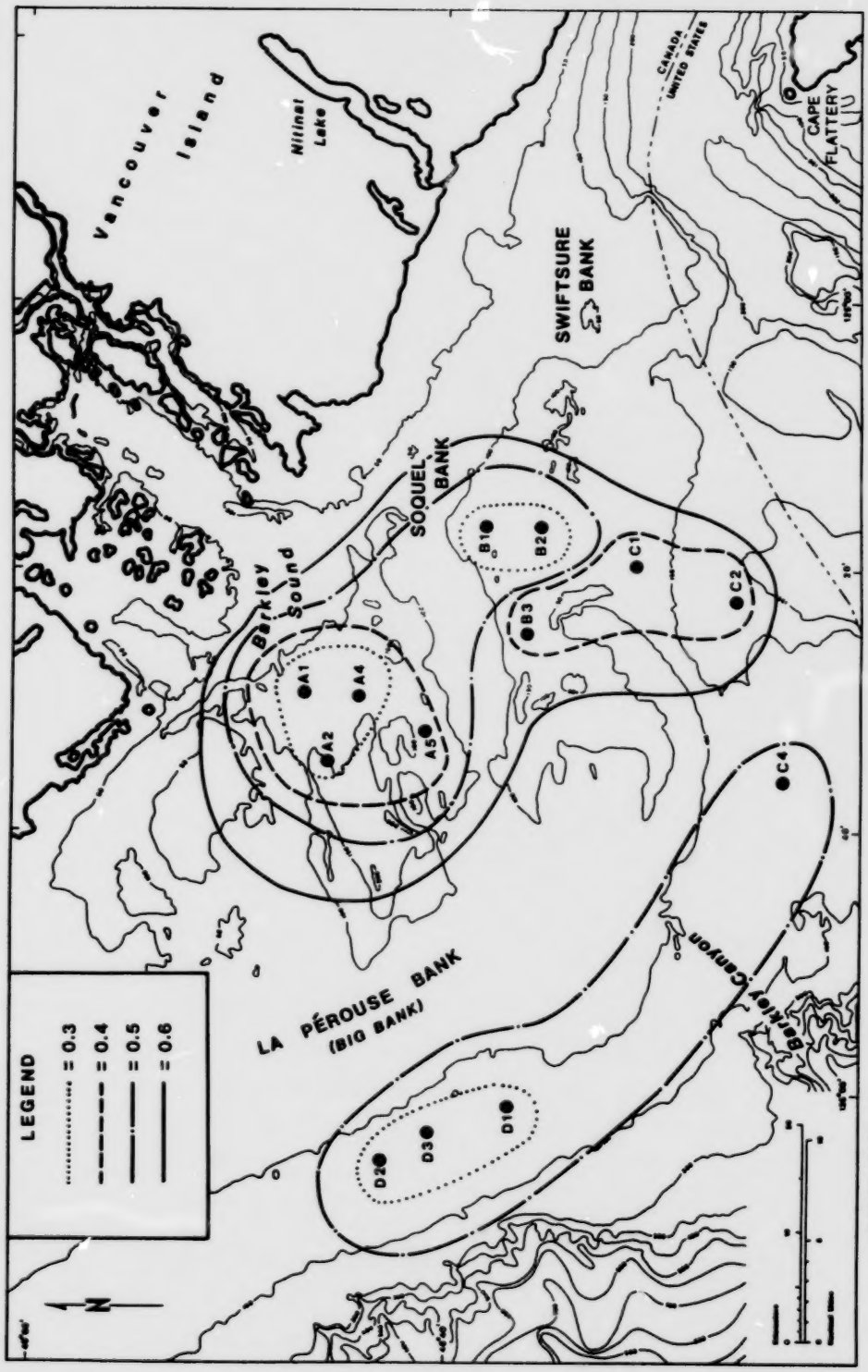


Figure 6. Map illustating the cluster pattern of stations with arbitrarily selected dissimilarity levels, to show groupings of stations in cruise 1.

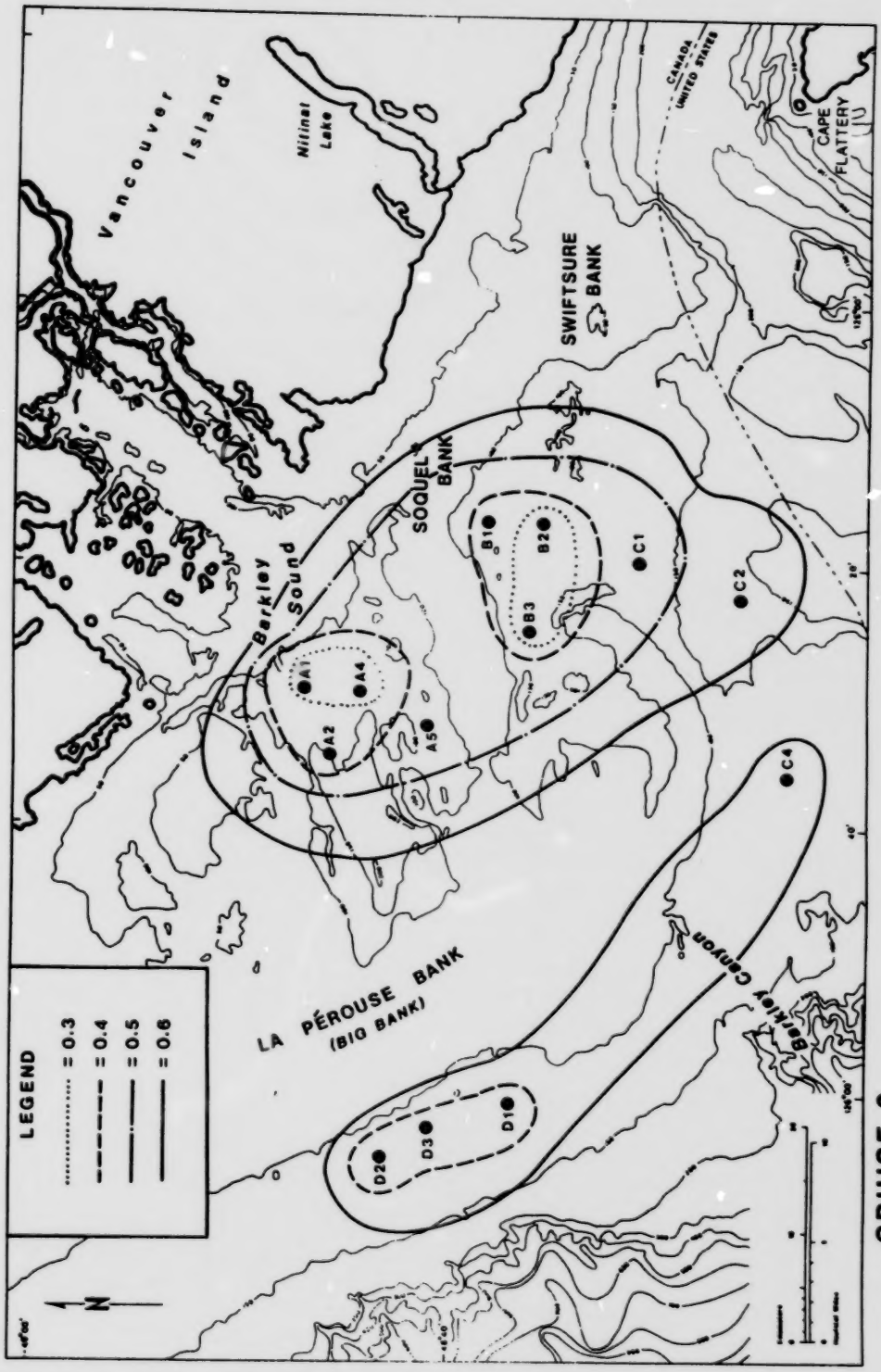


Figure 7. Map illustrating the cluster pattern of stations with arbitrarily selected dissimilarity levels, to show groupings of stations in cruise 2.

a) There is no resemblance between chlorophyl-a and the cluster pattern of stations for either cruise.

b) The cluster patterns for percent silt/clay and carbon content of sediments show the same grouping of two major stations found in the abundance cluster analyses for Cruises 1 and 2, including a "silt/clay" group and a "sandy" group with higher carbon content in the first group. The sandy group of C4-D3 (except for C4 in carbon content - Cruise 2) and the silt/clay group (A1-C2) are very dissimilar to each other (60-80%). However, the subclusters within the silt/clay community (A1-C2) and the sand (C4-D3) community evident in the abundance dendrogams do not appear to be related to silt/clay or carbon content of sediment.

c) The geographic cluster pattern shows that each station should cluster with its nearest neighbor (A's, B's, C's and D's together). The comparison of this reference dendrogram with the abundance dendrograms indicates that the groupings of A1-A5, B1-B2, C1-C2 and D1-D3 in Cruise 1, and A1-A4, B1-C2 and D1-D3 in Cruise 2 are explainable by proximity of stations, but the separation of the two major groups (silt/clay vs sand) is not, since C4 does not cluster with D1-D3 in the geographic reference dendrogram, but does in the abundance dendrograms due to sediment type.

The statistical comparison of the two abundance dendrograms (Cruises 1 and 2) indicate that the Ho (two dendrograms are the same) cannot be rejected at any linkage level (Appendix 8). Visual inspection of the results confirms that the two cruises are very similar overall.

BIOMASS

Results for methods 1 and 2 show extremely high variances between replicate samples of a single core (O'Connell et al. 1983a). As well, there are no data for stations D1-D3 for Cruise 2. For these reasons and the fact that results for method 1 are completely at odds with results for method 2, the biomass data will be archived at the Institute of Ocean Sciences and will not be presented here. In general, there were no discernable patterns in biomass distribution.

DISCUSSION

The data in this report represent a first attempt to describe the fauna of a relatively deep-water soft bottom area on the open shelf off British Columbia. The geology and sediment composition of the study area is unusual compared to the rest of Vancouver Island because of the glacial history and geological configuration. Stations in area A are in fairly still troughs or holes which are subject to low current action (Herzer and Bornhold 1982). These deep holes receive mud and sand winnowed from the tops of the shallower truncated morraines by the strong currents in surrounding areas, where gravel and coarser sand are left behind. Stations in areas B and C are similarly deep, but are more closely connected with the open ocean and may be subject to somewhat stronger current action. Area D stations have well-scoured sandy substrate from

which silty sediments are continuously carried away, so that the fauna here could be expected to differ from that at areas A, B, and possibly C. Carbon/Nitrogen ratios are in agreement with previous measurements from this area by personnel at the Institute of Ocean Sciences (B. Bornhold, Pacific Geoscience Centre - unpublished data).

Two communities were identified in the cluster analyses (Figures 6,7). The comparison of the abundance data with dendrograms of silt/clay content and carbon content of the soil (Appendix 7) suggest that sediment characteristics strongly influence the species composition of these benthic communities, thus producing a low organic "sand" and a high organic "silt/clay" assemblage, with different species compositions but similar overall abundances and numbers of species.

The fact that species numbers and total abundances of animals per grab were not different in the "sandy" stations compared with the "silt/clay" stations suggests that the organic material available for macrobenthic production may not be that different in the two sediment regimes. The biomass data for the present study (O'Connell et al. 1983a), though variable, do not indicate any differences between stations. The strong current action at the sandy stations should provide considerable suspended organic material for filter feeders. Therefore, the different species compositions of each of the two communities may be related to feeding modes. Closer examination of polychaete feeding guilds in the two communities (O'Connell 1983a,b) may confirm or disprove this theory.

The subclusters within each sediment regime were fairly consistent between the two cruises. The reference dendrograms based on carbon content and sediment particle size (Appendix 7) show that these environmental parameters are not potentially causative factors for the subclustering within either the silt/clay (A1-C2) regime or the sand (C4-D3) regime. Visual examination of Figures 6 and 7 reveal that the clusters within stations A1-C2 develop mostly in concentric circles. There are two exceptions. The first exception is the B3-C1-C2 subgroup in Cruise 1 (Figure 6), which is separated at a dissimilarity level of 0.6 from the other "silt/clay" stations (significance of 7%). The second exception is the grouping of A5 and C1 in Cruise 2 (Figure 5), which had a dissimilarity level of 0.4 to the rest of the "silt/clay" stations (significance of 4%). However, A5 had a high sand content in Cruise 2, making it anomolous to the rest of the silt/clay stations in either cruise. Aside from these exceptions, there is a convincing suggestion that within a particular sediment regime, stations tend to cluster most closely with their nearest neighbors. Similarly C4 clustered only distantly with the remote D stations even though it had the same sediment type. This "geographic" clustering is illustrated by the cluster pattern based on geographic distance between stations (Appendix 7).

To summarize, results of the statistical analyses of the abundance data for the two cruises shows that the dominant factor influencing species assemblage is sediment structure (particle size and organic content), whereas geographic distance between stations is the dominant factor influencing clustering within a sediment regime.

Because of the inadequacy of the sample methods for pigment content of sediments (use of varying amounts of pore water from core samples) and the evidence that the sediment composition (and therefore nutrient content) of each sample station is controlled by the sorting action of strong currents (Herzer and Bornhold 1982), it is unlikely that benthic production could be closely related to the primary productivity of overlying waters. As well, there were no notable differences in biomass (O'Connell et al. 1983a), species numbers and abundances between all the sampled stations, or between the two sediment regimes. Therefore, there is no support in this study for the hypothesis that benthic community structure is related to primary productivity in the area studied.

There was no clear indication of impact from low oxygen intrusions into the stations of area C, since the total numbers of animals in C1 and C2 were higher in Cruise 2 than in Cruise 1. The low oxygen conditions should have been in existence for the time period between Cruises 1 and 2, so that any low oxygen effect should have been most noticeable in Cruise 2. Nevertheless, it should be noted that C1 and C2 had 30-65% lower abundances of animals in Cruise 1 than any other stations or times.

Previous benthic faunal studies in British Columbia have been based on shallower communities, or in the fjords and straits (Levings et al. 1983, Ellis 1968, 1971, Bernard 1978). Comparable studies from the coast of Washington include Lie (1969), Lie and Kelley (1970) and Lie and Kisker (1970). Lie and Kelley (1970) used factor analysis to distinguish 3 communities in Puget Sound, based on selected taxa only (e.g. no polychaetes, etc.). Two of these communities were associated with sand. The first (exposed shallow-water sand-bottom) was oriented alongshore at depths of from 15-83m, but no equivalent habitat was sampled in the present study. The second sand-related community (intermediate depth sand-bottom community) occupied the deep edges of areas contiguous to the first. The other community defined by Lie and Kelley (1970) was a deep-water mud bottom community. The deep sandy habitat and the muddy habitat were similar to those sampled in the current study.

The samples from the Puget Sound studies were screened using 1mm mesh sieves (whereas the present study used 0.25mm sieves), and many of the species sampled were not identified or included in analysis of data. Therefore it is not possible to compare these studies with the current one in any detail. In spite of these differences, many of the same species that were abundant in the mud and deep sand bottom communities in Puget Sound were common in the present study. For example, the deep-water mud-bottom community identified by Lie and colleagues had the following species recorded as dominants: the echinoid Brisaster latifrons; the polychaetes Prionospio steenstrupi (=malmgreni), Ninoe gemmea and Sternaspis scutata (=fossor); the bivalves Axinopsida serricata, Adontorhina cyclia and Macoma carlottensis; and the amphipod Heterophoxus oculatus. Most of these species were common in the shelf silt/clay stations A1-C2. The deep-water mud-bottom community had a reported mean abundance of 266 individuals per square meter, compared with about 20x this number for the current study. The large differences in abundances are presumably due to the difference in mesh sizes used for sampling. The intermediate sand-bottom community (Lie and Kisker 1970) included the following dominant species which were also abundant in the sandy shelf

stations in the current study: the polychaete Prionospio steenstrupi, the mollusc Macoma elimata; the amphipod Ampelisca careyi (=macrocephala).

The review by Ellis (1971) indicates that many of the same species dominant in Puget Sound are also common species in Satellite Channel, near Sidney, British Columbia. The studies in Satellite Channel (using sieve sizes of 1mm) did not include the detailed taxonomic identifications done for the present study, since many taxa were only identified to genus. Ellis (1971) suggested that the communities found in Satellite Channel and in Puget Sound have similarities to the complex of Amphiodia- Maldane-Ophiura communities described by Thorson (1957) in his description of parallel communities. However, because of the greatly more detailed taxonomic identifications, and the much smaller screen used for sampling, it is difficult to compare the current study with previous ones, or to fit the species assemblages identified into any of the classic community types discussed by these various authors.

Lie and Kisker (1970) concluded that sediment type was the overwhelmingly dominant environmental factor affecting the community structure in Puget Sound. Results of the western Vancouver Island study support this conclusion, with the added comment that within a given sediment type other factors such as geographic distance are important. It is possible that depth would be an important factor in determining species assemblages, but the depth of stations did not vary greatly in this study and there were no depth related effects observed for either cruise.

On the basis of samples taken in Puget Sound over a period of 7 years, Lie and Evans (1974) concluded that there was long term stability in the dominant species assemblages of 4 selected stations in Puget Sound, even though the abundance of each species might change considerably over time. The statistical comparison of the two cruises in the current study support this theory, since the null hypothesis that the two abundance matrices were the same could not be rejected at any linkage level. The abundant species found in each of the two assemblages in Cruise 1 were also predominent in the second cruise, suggesting that there may be temporal stability in the two communities identified. Longer- term studies on the shelf off Vancouver Island could confirm or disprove this hypothesis.

ACKNOWLEDGMENTS

This project was funded by the Government of Canada through an Unsolicited Proposal to the Department of Supply and Services, which provided the bulk of the funds for the initial part of the study (Contract ISBB1-00001). Mr. C.C. Touwslager (Science Procurement, DSS) was of considerable assistance throughout the life of the contract. Mr. G.R. Smith (IOS) contributed funds to the project and much more in terms of management and advice.

Dobrocky Seatech Limited of Sidney, B.C. was the principal contractor for the project. All of the managerial, biological and support staffs of the company were involved in this large project, but special reference

must be made to the contributions of R.W. Drinnan, S. Woods, S.C. Byers, G.W. O'Connell, and the late J. Dobrocky. Subsequent contracts to E.V.S. Consultants Ltd. of N. Vancouver were administered by Dr. P.M. Chapman and R.D. Kathman, S.F. Cross and P. J. Tchaplinski, with funding provided by Employment and Immigration Canada through the Job Development Project.

Several members of the Institute of Ocean Sciences assisted in this project. Drs. D. Mackas and K. Denman provided data on chlorophyll a and phaeopigments in sediments and near-bottom water and considerable advice, aid and comfort. Dr. B. Bornhold provided information useful in selecting study locations, and made facilities available for analysis of sediment properties. K. Bruce and D. Karasiuk compiled tables and edited text for drafts of this report, while J. Tudway-Cains made camera-ready versions of the illustrations. The final data analyses and technical report were prepared by B. Burd.

Taxonomic verifications and identifications were made by a wide range of experts, all listed in Table 1, whose contributions are gratefully acknowledged.

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Appendix 1. Checklist of the zoobenthos of the continental shelf off southwestern Vancouver Island.

INTERPRETIVE NOTES

1. This checklist includes all the species that have been collected, identified and verified from all grab, sled and trawl samples taken during this project.

2. The order of taxa in this list follows S. P. Parker (ed. 1982).

3. Identifications of the species in this list are by the taxonomic specialists listed in Table 1.

4. The nomenclature in this report follows Austin (1983). Where synonyms exist, the name preferred by Austin is the one used in this report. The authorship ascribed to each scientific name is also taken from Austin (1983).

5. The symbol (*****) following a species name indicates that O'Connell et al. (1983a,1983b) list the species, but did not send a voucher specimen to be confirmed by a taxonomic specialist.

Appendix 1. Checklist of the zoobenthos of the continental shelf off southwestern Vancouver Island.

PHYLUM SARCOMASTIGOPHORA
CLASS GRANULORETICULOSA
O. FORAMINIFERIDA
Fam. Astrorhizidae
Rhizammina sp. A
-sp. B

Fam. Saccaminidae
Lagenammina sp.
Saccammina sp.

Fam. Hormosinidae
Reophax sp. A
-sp. B
-sp. C

Fam. Lituolidae
Cribrostomoides sp.
Haplophragmoides sp. A
-sp. B

Fam. Trochamminidae
Trochammina sp.

Fam. Ataxophragmiidae
Gaudryina sp.

Fam. Fisherinidae
Cyclogyra sp.

Fam. Miliolidae
Triloculina sp.

Fam. Nodosariidae
Amphicoryna sp.
Lagena sp.
Lenticulina sp.
Nodosaria sp.
Palmula sp.

Fam. Polymorphinidae
Polymorphina sp.
Sigmomorphina sp.

Fam. Bolivinitidae
Bolivina sp.

Fam. Buliminidae
Globobulimina sp.

Fam. Uvigerinidae
Uvigerina sp.

Fam. Discorbidae
Buccella sp.

Fam. Elphidiidae
Elphidiella sp.
Elphidium sp. A
-sp. B

Fam. Cibicididae
Cibicides sp. A
-sp. B

Fam. Cassidulinidae
Cassidulina californica
-limbata

Fam. Nonionidae
Florilus sp.
Nonionellina sp.
Pullenia sp.

Fam. Alabaminidae
Gyroidina sp.

PHYLUM CNIDARIA
CLASS HYDROZOA
ORDER ANTHOMEDUSAE
Fam. Velellidae
Velella velella (Linnaeus)

CLASS ANTHOZOA
ORDER PENNATULACEA
Fam. Virgulariidae
Virgularia cf. tuberculata Marshall

Fam. Stachyoptilidae
Stachyoptilum superbum Studer

PHYLUM PLATYHELMINTHES
CLASS TURBELLARIA
No attempt to identify specimens further

PHYLUM NEMERTEA
Identifications not complete
at time of writing

Appendix 1 (cont.)

PHYLUM KINORHYNCHA
ORDER HOMALORHAGIDA
Fam. Pycnophyidae
Kinorhynchus cataphractus (Higgins)
-ilyocryptus (Higgins)
Pycnophyes sanjuanensis Higgins

PHYLUM NEMATA
Identifications not complete
at time of writing

PHYLUM MOLLUSCA
CLASS CAUDOFOVEATA (APLACOPHORA-in part)
ORDER CHEATODERMATIDA
Fam. Crystallophrissonidae
Crystallophrisson sp.

Fam. Chaetodermatidae
Chaetoderma argentum (Heath)
-sp. A

Fam. Limifossoridae
Limifossor talpoideus (Heath)

Fam. Scutopodidae
Scutopus sp. (?)

CLASS POLYPLACOPHORA
Identifications not complete

CLASS GASTROPODA
ORDER ARCHAEOGASTROPODA
Fam. Trochidae
Bathybembix cidaris
Margarites lirulatus Carpenter
Solariella varicosa (Mighels and Adams)

Fam. Liotiidae
Cyclostrema indet.

ORDER MESOGASTROPODA
Fam. Rissoidae
Alvania rosana Bartsch

Fam. Cerithiidae
Bittium vancouverense Dall and Bartsch

Fam. Epitoniidae
Epitonium catalinae Dall
-sawinae (Dall)

Fam. Eulimidae
Eulima rutila (Carpenter)

Fam. Calyptraeidae
Crepidula lingulata (Gould)

Fam. Naticidae
Polinices pallidus Broderip and Sowerby

ORDER NEOGASTROPODA
Fam. Muricidae
Boreotrophon dalli (Kobelt)

Fam. Buccinidae
Colus halli (Dall)
Mohnia frielei Dall
Plicifusus brunneus Dall

Fam. Nassariidae
Nassarius cf. mendicus (Gould)*****

Fam. Columbellidae
Amphissa columbiana Dall
Nitidella gouldi (Carpenter)

Fam. Cancellariidae
Admete couthouyi (Jay)

Fam. Turridae
Antiplanes voyi (Gabb)
Cryptogemma adrastia Dall
Oenopota cf. elegans (Moller)
Ophiodermella cancellata (Carpenter)
-incisa (Carpenter)
Rectiplanes piona Dall

ORDER PYRAMIDELLIDA
Fam. Pyramidellidae
Odostomia avellana Carpenter
-barkleyensis Dall and Bartsch
-hypatia Dall and Bartsch
-tenuisculpta Carpenter
Turbonilla aurantia (Carpenter)

ORDER CEPHALASPIDEA
Fam. Retusidae
Volvulella cylindrica (Carpenter)

Fam. Philinidae
Philine polaris Aurivillius

Fam. Gastropteridae
Gastropteron pacificum Bergh

Fam. Cylichnidae
Acteocina culcitella (Gould)
Cylichna attonsa Carpenter

CLASS CEPHALOPODA
ORDER SEPIOLIDAE
Fam. Sepiolidae
Rossia pacifica Berry

Appendix 1 (cont.)

ORDER OCTOPODA
Fam. Octopodidae
Octopus sp.

CLASS BIVALVIA
ORDER NUCULOIDA
Fam. Nuculidae
Nucula belloti Adams

Fam. Nuculanidae
Nuculana amiata (Dall)
-extenuata (Dall)
-hindsii (Hanley)
-leonina (Dall)
-minuta (Fabricius)
-navisa (Dall)
Yoldia martyria Dall
-scissurata Dall
-thraciaeformis (Storer)

ORDER SOLEMYOIDEA
Fam. Manzanellidae
Huxleyia munita (Dall)

ORDER MYTILLOIDEA
Fam. Mytillidae
Crenella decussata (Montagu)
Musculista senhousei (Benson)
Musculus niger (Gray)

ORDER PTERIOIDA
Fam. Pectinidae
Delectopecten vancouverensis (Whiteaves)
Pecten caurinus Gould

ORDER VENEROIDA
Fam. Lucinidae
Lucina tenuisculpta Carpenter
Lucinoma annulata (Reeve)

Fam. Ungulinidae
Diplodonta orbella (Gould)

Fam. Thyasiridae
Adontorhina cyclia Berry
Axinopsida serricata (Carpenter)
Thyasira cygnus Dall
-gouldi (Philippi)

Fam. Leptonidae
Naeromya compressa (Dall)
Mysella compressa (Dall)
-tumida (Carpenter)

Fam. Lasaeidae
Lasaea cistula Keen

Fam. Carditidae
Cyclocardia ventricosa (Gould)

Fam. Astartidae
Tridonta rollandi (Bernard)

Fam. Cardiidae
Nemocardium centifilosum Carpenter

Fam. Solenidae
?Solen sicarius Gould

Fam. Tellinidae
Macoma alaskana Dall
-carlottensis Whiteaves
-eliminata Dunnill and Coan
Tellina carpenteri Dall
-modesta (Carpenter)

Fam. Veneridae
Compsomyax subdiaphana (Carpenter)
Psephidia lordi (Baird)

Fam. Cooperellidae
Cooperella subdiaphana (Carpenter)

ORDER MYOIDA
Fam. Hiatellidae
Hiatella arctica (Linnaeus)

ORDER PHOLAMYOIDA
Fam. Lyonsiidae
Lyonsia bracteata (Gould)
-californica Conrad
-scammoni (Dall)

Fam. Pandoridae
Pandora bilirata Conrad
-filosa (Carpenter)
-grandis Dall

Fam. Cuspiardiidae
Cardiomya californica (Dall)
-olroydi (Dall)
-pectinata (Carpenter)
-pseutes (Dall)

CLASS SCAPHOPODA
ORDER GADILIDA
Fam. Cadulidae
Cadulus aberrans Whiteaves
-californicus (Pilsbry and Sharp)
-tolmiei Dall
Pulsellum salishorum Marshall

ORDER DENTALIDA
Fam. Dentalidae
Dentalium rectius Carpenter

Appendix 1. (cont'd)

PHYLUM ANNELIDA
CLASS POLYCHAETA
ORDER ORBINIIDA
Fam. Orbiniidae
Leitoscoloplos pugettensis (Pettibone)
Orbinia felix (Kinberg)
Scoloplos acmeceps Chamberlin

Fam. Paraonidae
Aricidea lopezi Berkeley and Berkeley
-minuta Southward
-neosuecica Hartman
-quadrilobata Webster and Benedict
-ramosa Annenkova
-suecica Eliason
Levinsenia gracilis (Tauber)

ORDER COSSURIDA
Fam. Cossuridae
Cossura soyeri Laubier
-sp. nov.

ORDER SPIONIDA
Fam. Apistobranchidae
Apistobranchus tullbergi (Theel)

Fam. Spionidae
Laonice cirrata (Sars)
Paraprionospio pinnata (Ehlers)
Polydora brachycephala Hartman
-cf. cardalia Berkeley
-socialis (Schmarda)
Prionospio cirrifera Wiren
-steenstrupi Malmgren
Spio filicornis (Moller)
Spiophanes berkeleyorum Pettibone

Fam. Trochaetidae
Trochaeta multisetosa (Oersted)

Fam. Magelonidae
Magelona berkeleyi Jones
-longicornis Johnson

Fam. Chaetopteridae
Chaetopterus variopedatus (Renier)
Spiochaetopterus costarum (Claparede)

Fam. Cirratulidae
Cauleriella sp.
Chaetozone acuta Banse and Hobson
-setosa Malmgren
-spinosa Moore
Cirratulus cirratus (Moller)

Cirratulidae, continued
Tharyx multifilis Moore
-secundus Banse and Hobson
-tesselata Hartman

ORDER CAPITELLIDA
Fam. Capitellidae
Decamastus gracilis Hartman
Heteromastus filobranchus Berkeley and Berkeley
Mediomastus ambiseta (Hartman)
-californiensis Hartman
Notomastus lineatus Claparede
-tenuis Moore

Fam. Maldanidae
Asychis disparidentata (Moore)
-similis (Moore)
Clymenura columbiana (Berkeley)
Euclymene cf. zonalis (Verrill)
Maldane glebifex Grube
-harai (Izuka)
Micromaldane ornithochaeta Mesnil
Nichomache lumbricalis (Fabricius)
Notoproctus pacificus (Moore)
Petaloproctus tenuis tenuis (Theel)
-t. borealis Arwidsson
Praxillella affinis pacifica Berkeley
-gracilis (Sars)
Rhodine bitorquata Moore

ORDER OPHELIIDA
Fam. Scalibregmidae
Scalibregma inflatum Rathke

Fam. Opheliidae
Ophelina acuminata (Oersted)
-breviata (Ehlers)
Travisia brevis Moore
-pupa Moore

ORDER PHYLLODOCIDA
Fam. Aphroditidae
Aphrodita japonica Marenzeller

Fam. Polynoidae
Antinoella macrolepida (Moore)
Arcteobea spinelytris Ushakov
Arctonoe pulchra (Johnson)
-vittata (Grube)
Eunoe depressa (Moore)
-senta (Moore)
-uniseriata Banse and Hobson
Gattyana ciliata Moore
-treadwelli Pettibone

Appendix 1. (cont'd)

Polynoidae, continued
Harmothoe extenuata (Grube)
-lunulata (delle Chiaje)
Lepidasthenia berkeleyae Pettibone
-longicirrata Berkeley
Lepidonotus squamatus (Linnaeus)
Polynoe canadensis (McIntosh)
Tenonia kitaspensis Nichols

Fam. Polyodontidae
Pholoides aspera (Johnson)

Fam. Sigalionidae
Pholoe minuta (Fabricius)

Fam. Phyllodocidae
Eteone longa (Fabricius)
Eulalia levicornuta Moore
-sanguinea Oersted
Mystides borealis Theel
Phyllodoce groenlandica Oersted

Fam. Hesionidae
Gyptis brevipalpa (Hartmann-Schroeder)

Fam. Pilargidae
Parandalia fauveli(Berkeley and Berkeley)
Pilargis berkeleyae Monro
Sigambra tentaculata (Treadwell)

Fam. Syllidae
Autolytus cornutus Agassiz
Eusyllis magnifica (Moore)
Exogene gemmifera Pagenstecher
-lourei Berkeley and Berkeley
-molesta Banse
Odontosyllis phosphorea Moore
Pionosyllis uraga Imajima
Sphaerosyllis brandhorsti Hartmann-Schroeder
Syllides longocirrata Oersted
Syllis cf. alternata Moore
-cf. elongata (Johnson)
-harti Berkeley and Berkeley
-heterochaeta Moore
Typosyllis sp.

Fam. Nereidae
Cheilonereis cyclurus (Harrington)
Nereis procera Ehlers
-zonata Malmgren

Fam. Nephtyidae
Nephtys assignis Hartman
-cornuta cornuta Berkeley and Berkeley
-ferruginea Hartman
-punctata Hartman

Fam. Sphaerodoridae
Sphaerodoropsis minuta (Webster and Benedict)
-sphaerulifer (Moore)

Fam. Glyceridae
Glycera americana Leidy
-capitata Oersted

Fam. Goniadidae
Glycinde armigera Moore
Goniada brunnea Treadwell
-maculata Oersted

ORDER EUNICIDA
Fam. Onuphidae
Onuphis conchylega Sars
-geophiliformis (Moore)
-iridescens (Johnson)

Fam. Lumbrineridae
Lumbrineris bicirrata Treadwell
-cruzensis Hartman
-luti Berkeley and Berkeley
Ninoe gemmea Moore
Paraninoe simpla (Moore)

Fam. Arabellidae
Drilonereis cf. falcata Moore
-falcata minor Hartman
-longa Webster

Fam. Dorvilleidae
Dorvillea sp.
Ophryotrocha sp.
Schistomeringos caeca (Webster and Benedict)
-cf. longicornis (Ehlers)
-rudolphi (Berkeley and Berkeley)

ORDER STERNASPIDA
Fam. Sternaspidae
Sternaspis scutata (Renier)

ORDER OWENIIDA
Fam. Oweniidae
Myriochele heeri Malmgren
-oculata Zachs
Owenia fusiformis delle Chiaje

Appendix 1 (cont.)

ORDER FLABELLIGERIDA
Fam. Flabelligeridae
Brada sachalina Annenkova
Pherusa negligens (Berkeley and Berkeley)
-plumosa (Möller)

ORDER TEREBELLIDA
Fam. Sabellariidae
Idanthyrsus armatus Kinberg
Sabellaria cementarium Moore

Fam. Amphictenidae
Pectinaria californiensis Hartman
-granulata (Linnaeus)

Fam. Ampharetidae
Amage anops (Johnson)
Ampharete acutifrons (Grube)
-finmarchia (Sars)
Amphicteis mucronata Moore
-scaphobranchiata Moore
Lysippe labiata Malmgren
Melinna cristata (Sars)
-elisabethae McIntosh
Samytha cf. californiensis Hartman
Schistocomus hiltoni Chamberlin

Fam. Terebellidae
Artacama coniferi Moore
Artacmella hancocki Hartmann
Neoamphitrite edwardsi (Quatrefages)
Pista brevibranchiata Moore
-cristata (Möller)
-moorei Berkeley and Berkeley
Polycirrus sp. III Hobson and Banse
Proclea graffii (Langerhans)
Scionella japonica Moore
Thelepus setosus (Quatrefages)

Fam. Trichobranchidae
Terebellides stroemi Sars
Trichobranchus glacialis Malmgren

ORDER SABELLIDA
Fam. Sabellidae
Chone magna (Moore)
Euchone arenae Hartman
-incolor Hartman
Jasmineira pacifica Annenkova
Megalomma splendida (Moore)
Potamilla intermedia (Moore)
Sabella media (Bush)

Fam. Serpulidae
Crucigera nr. irregularis Bush

CLASS OLIGOCHAETA
ORDER TUBIFICIDA
Fam. Enchytraeidae
Grania sp.

Fam. Tubificidae
Limnodriloides cf. barnardi Cook
-victoriensis Brinkhurst and Baker
Tectidrilus diversus Erseus
Tubificoides cf. bakeri

PHYLUM ECHIURA
CLASS ECHIURIDA
ORDER ECHIUROINEA
Fam. Bonelliidae
Nellobia eusoma Fisher

Fam. Echiuridae
Echiurus echiurus (Pallas)

Fam. Thalassematidae
Arhynchite cf. pugettensis Fisher

PHYLUM SIPUNCULA
ORDER SIPUNCULA
Fam. Golfingiidae
Golfingia sp.
Phascolion sp.

Fam. Phascolosomatidae
Phascolosoma sp.

PHYLUM ARTHROPODA
CLASS CRUSTACEA
SUBCLASS OSTRACODA
Fam. Macrocypridae
Macrocypris sp.

Fam. Paracyprídae
Paracypris sp.

Fam. Cytheridae
? Munseyella sp.

Fam. Bythocyprididae
Bythocypris sp.

Fam. Krithidae
Krithe sawanensis Hanai

Fam. Cytheruridae
Cytheropteron sp.

Appendix 1. (continued)

Fam. Pectocytheridae
? Leptocythere sp.
Pectocythere clavata (Triebel)

Fam. Schizocytheridae
Palmenella californicus Triebel

Fam. Trachyleberididae
Cletocythereis noblissimus Swain

Fam. Cypridinidae
? Cypridina sp.
Philomedes trituberculatus Lucas

SUBCLASS COPEPODA
ORDER HARPACTICOIDA
Fam. Diosaccidae
Typhanlamphiascus cf. typhlops
Bulbamphiascus imus

Fam. Cletodidae
Acrenhydrosoma cf. perplexum
Enhydrosoma sp. A
Eurycletodes sp. A
-sp. B
Paranannopus sp. A
Stenhelia sp. A
-sp. B
-sp. C

Fam. Cerviniidae
Bradya cf. typica
Ectinosomatid sp. A
-sp. B
-sp. C
-sp. D
Cervinia synartha

Fam. Harpactidae
Harpacticus sp. A

Fam. Tachidiidae
Psammis sp. A

Fam. Thalestridae
Dactylopodia sp. A
-sp. B

Fam. Tisbidae
Tisbe sp. A

Fam. Ancorabolidae
Anchorabolus sp. A

Fam. Tetragonicipitidae
Tetragoniceps sp. A

ORDER CYCLOPOIDA
Identifications not complete
at time of writing

ORDER THORACICA
Fam. Lepadidae
Lepas anatifera Linnaeus

ORDER MYSIDACEA
Fam. Mysidae
Disacanthomysis dybowskii (Dershavin)
Holmsiella anomala Ortmann
Inusitatomysis insolita Ii
Meterythrops robusta S.I. Smith
Neomysis kadiakensis Ortmann
Pacificanthomysis nephropthalma (Banner)
Pseudomma truncatum S.I. Smith
Stilomysis grandis (G̈es)

ORDER CUMACEA
Fam. Leuconidae
Eudorella pacifica Hart
Eudorellopsis longirostris Given
Leucon cf. nasica (Kroyer)

Fam. Nannastacidae
Campylaspis canaliculata Zimmer
-rubicunda (Lilljeborg)
-rubromaculata (Lie)
Cumella vulgaris Hart

Fam. Lampropidae
Hemilamprops californica Zimmer
-gracilis Hart
Lamprops serrata Hart

Fam. Diastylidae
Diastylis bidentata Calman
-hirsuta Lomakina
-paraspinulosa Zimmer
-pellucida Hart
-sp. nov.
Diastylopsis dawsoni Smith
Leptostylis macrura Sars
-sp. nov.
Pentalosarsia declivis (G.O. Sars)

ORDER TANAIDACEA
Fam. Leptognathiidae
Araphura brevimana (Lilljeborg)

Appendix 1. (continued)

Fam. Pholidae (Isaeidae)
Pholis brevipes Shoemaker
-cf. lacia Conlan
-cf. pachydactyla Conlan
-macinerneyi
-fischmanni
Protomedia prudens

Fam. Podoceridae (Dulichiidae)
Dyopedos sp. A cf. normani *****

Fam. Hyalidae

Fam. Ischyroceridae

Fam. Stenothoidae

SUBORDER CAPRELLIDEA
Fam. Caprellidae
Caprella gracilior Mayer
-irregularis Mayer
Mayerella sp.

ORDER EUPHAUSIACEA
Fam. Bentheuphausiidae
Euphausia pacifica Hansen
Thyasanoessa spinifera Holmes

ORDER DECAPODA
Fam. Pandalidae
Pandalus jordani Rathbun
-platyceros Brandt
-stenoloepis Rathbun

Fam. Hippolytidae
Eualus avinus (Rathbun)
-berkeleyorum Butler
-lineatus Wicksten and Butler
-pusiolus (Kroyer)
Heptacarpus decorus (Rathbyn)
Lebbeus grandimanus (Brazhnikov)
Spirontocaris arcuata Rathbun
-holmesi Holthuis
-lamellicornis (Dana)
-ochotensis (?) Brandt
-truncata Rathbun

Fam. Crangonidae
Argis alaskensis (Kingsley)
Crangon alaskensis Lockington
Lissocrangon stylirostris (Holmes)
Metacrangon munita (Dana)
-spinosissima (Rathbun)
Neocrangon communis (Rathbun)
-resima (Rathbun)
Paracrangon echinata Dana

Fam. Diogenidae
Paguristes turgidus (Stimpson)

Fam. Paguridae
Pagurus aleuticus (Benedict)
-confragosus (Benedict)
-ochotensis Brandt
-setosus (Benedict)

Fam. Aoridae
Aoroides inermis Conlan and Bousfield

Fam. Parapaguridae
Lopholithodes foraminatus (Stimpson)

Fam. Galatheidae
Munida quadrispina Benedict

Fam. Majidae
Chorilia longipes Dana
Oregonia gracilis Dana

Fam. Pinnotheridae
Pinnixa schmitti Rathbun

PHYLUM BRYOZOA
ORDER CTENOSTOMATA
Pherusella sp.

PHYLUM BRACHIOPODA
CLASS ARTICULATA
ORDER TEREBRATULIDA
Fam. Terebratulidae
Terebratulina unguicula Carpenter

Fam. Laqueidae
Laqueus californianus Koch

PHYLUM ECHINODERMATA
CLASS STELLEROIDEA
ORDER PLATYASTERIDA
Fam. Luidiidae
Luidia foliolata Grube

Appendix 1. (continued)

ORDER FORCIPULATA
Fam. Asteriidae
Stylasterias forreri (de Loriol)

ORDER PHRYNOPHIURIDA
Fam. Gorgonocephalidea
Gorgonocephalus eucnemis Moller and Troschel

ORDER OPHIURIDA
Fam. Ophiuridae
Ophiura luetkeni (Lyman)
-sarsi Lutken

Fam. Amphiuridae
Amphioplus macraspis (H.L. Clark)
-strongyloplax (H.L. Clark)
Amphipholis pugetana (Lyman)

CLASS ECHINOIDEA
ORDER ECHINOIDA
Fam. Strongylocentrotidae
Allocentrotus fragilis (Jackson)
Strongylocentrotus pallidus (G.O. Sars)

ORDER SPATANGOIDA
Fam. Schizasteridae
Brisaster latifrons (Agassiz)

CLASS HOLOTHUROIDEA
ORDER DENDROCHIROTIDA
Fam. Psolidae
Psolus cf. squamatus (Koren)

Fam. Phyllophoridae
Pentamera populifera (Stimpson)
-pseudocalcigera Deichmann

ORDER ASPIDOCHIROTIDA
Fam. Stichopodidae
Parastichopus sp.

ORDER MOLPADIIDA
Fam. Molpadiidae
Molpadia intermedia (Ludwig)

ORDER APODIDA
Fam. Chirodotidae
Chirodota sp.

PHYLUM CHORDATA
SUBPHYLUM TUNICATA
CLASS ASCIDACEA
Fam. Corellidae
Chelyosoma columbianum Huntsman

Fam. Molgulidae
Molgula pugetiensis Herdman

SUBCLASS VERTEBRATA
CLASS CHONDRICHTHYES
ORDER RAJIFORMES
Fam Rajidae
Raja kincaidi Garman
-rhina Jordan and Gilbert

ORDER CHIMAERIFORMES
Fam. Chimaeridae
Hydrolagus colliei (Lay and Bennett)

CLASS OSTEICHTHYES
ORDER GADIFORMES
Fam. Gadidae
Merluccius productus (Ayres)
Theragra chalcogramma (Pallas)

Fam. Zoarcidae
Aprodon cortezianus Gilbert
Lycodes brevipes Bean
-diapterus Gilbert
Lycodopsis pacifica (Collett)

ORDER PERCIFORMES
Fam. Bathymasteridae
Ronquilus jordani (Gilbert)

Fam. Stichaeidae
Lumpenella longirostris(Evermann & Goldsborough)
Poroclinus rothrocki Bean

ORDER SCORPAENIFORMES
Fam. Scorpaenidae
Sebastes elongatus Ayres
-emphaeus (Starks)

Fam. Cottidae
Dasycottus setiger Bean
Icelinus filamentosus Gilbert
Icelus spiniger Gilbert
Radulinus asprellus Gilbert

Appendix 1. (continued)

Fam. Agonidae
Agonus acispenserinus Tilesius
Asterotheca alascana (Gilbert)
-infraspinata (Gilbert)
-pentacanthus (Gilbert)
Bathyagonus nigripinnis Gilbert
Xeneremtus leiops Gilbert

Fam. Cyclopteridae
Liparis fucensis Gilbert

ORDER PLEURONECTIFORMES
Fam. Bothidae
Citharichthys stigmaeus Jordan and Gilbert

Fam. Pleuronectidae
Eopsetta jordani (Lockington)
Glyptocephalus zachirus Lockington
Hippoglossoides elassodon Jordan & Gilbert
Lyopsetta exilis (Jordan and Gilbert)
Microstomus pacificus (Lockington)

Appendix 2. Numbers of organisms occurring in grab samples at stations occupied during Cruise 1.

INTERPRETIVE NOTES

1. Numbers in this table are the totals for all "water", "subcore" and "macro" samples at each replicate of each station.

2. Values for stations C4-A, D1-B, D2-A, D2-B, D3-A and D3-B are not comparable to the rest. At these stations, only six subcore samples were taken, but nine were taken at other stations.

Appendix 2. Numbers of organisms occurring in grab samples at stations occupied during Cruise 1.

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
CNIDARIA: CERIANTHARIA																									3
NEMERTEA	27	13	34	34	15	22	28	25	3	2	1		1	2	7	1	4	2	7	9	5	6	2	7	18
KINORHYNCHA																									
Kinorhynchus spp.	20	10	1	1	4	7			19	12	11	5	1		3	3			1	2		3	4		1
Pycnophyes sanjuanensis	9					5			5	5	2	5	1		2				4						
MOLLUSCA: APLACOPHORA																									
Chaetoderma argenteum			2	3	3	2	5	1	1		1	1	1			1		2	1	1					
-sp.A	1	1	1	1	4		2	3	2	1		2	1				3				2	1	1	4	
-undet.		1				1												3			1	2			
MOLLUSCA: GASTROPODA																									
Margarites lirulatus																			4						
Solariella varicosa	4	1			6	7		1			2	1		1	1						2			1	
Cyclostrema sp.		1																							
Alvania rosana															1					2	1		1	1	
Bittium sp.																								1	
Polinices pallidus					1				1								1				2				
Boreotrophon dalli																					1				
Mohnia frielei															1	1									
Plicifusus brunneus																					1				
Amphissa columbiana																				1					
Nitidella gouldi									5	3		3	1							3	5	2		2	
Admete cathouyi																								1	
Antiplanes voyi															1										
Cryptogemma adrastia																						1			
Ophiodermella incisa																						1			
Rectiplanes piona																								1	
Odostomia avellana	1				2				1	3	2	1	1	3		2				1	1	2			
-barkleyensis		1	1			2																	1	2	
-hypatia																						1			
Turbonilla sp.	3	4	1	1	2				2	4	2							1					2	1	
Actiocina culcitella			1		1		3			1										1		1			
Philine polaris	1																								
MOLLUSCA: BIVALVIA																									
Nucula belloti	7	4	1																						
Nuculana sp.		1	1								1	1	1		2				1	1	1	6			
Yoldia scissurata	14	8	6	12	19	17	11	8	3	3	6	3	3	1	1	1		1							
-thraciaeformis	2	3		3	4	7	8	6		2	2	2	3	4		1	1								
-sp.	3	1			2	1																			
Huxleya munita																			12	9	17	15	24	19	22
Crenella decussata																	1		48	5	4			1	3

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
	2																								

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STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
Musculista senhousei																			2						
Lucinoma annulata																						1	1		1
Lucinidae juv.	1	1			1					3	7	2	9	5	5	2		1							
Adontorhina cyclia	3	3	2	2	3	2	4	7	4	3	4	9	5	2	1	1	10	4		10	45	20	41	30	24
Axinopsida serricata	3	1			1	2	1	5	15	9	1	5	1	9	1	1	3	3			1				
Thyasira gouldi																	1	1		2		1		2	1
-sp.		3	3	2			1	6	2	12	8	3	1	6	2	2		2	1				1		
Thyasiridae indet.			2	2		2	5		1		4	1	3			3		2	1			11			1
Naereomya compressa								1																	
Cyclocardia ventricosa		1			1			1		2	3				1				1			1	1		3
Nemocardium centifilosum																			1					1	2
Macoma alaskana										1											3	1	6	2	3
-carlottensis	1	2		1	2	5	1	5			4	4	1	2	3	6	1	1							
-elimata	1	3		1			1	2	5	3	10		1		1	2		2		6		16			6
-sp.	3	3	2		4		1			5	1								1					2	3
Tellina modesta																			4	9	10	7	4	6	5
Compsomyax subdiaphana			1	1						4	4	2		2	1	1						1	1	1	1
Psephidia lordi								1														1			
Lyonsia bracteata	30	1																		1					1
Pandora filosa									1	4									1			2	1		1
-sp.				1	1														1				1	1	
Cardiomya californica									1	3										1		1			
-pseutes									1								1								
Bivalvia indet.	10	2	9	4	2	4	5	20	34		3	1	4		2			6	144	84	51	68	81	8	88
Bivalvia juv	77	53	99	34	24	107	9	26	24	22	3	10	10		10		3	2	1		1	8		31	
MOLLUSCA: SCAPHOPODA																									
Cadulidae indet.	8	5	5	8	12	13	24	44	4	4	10	18	19	14	13	10	3	4	3	5		9	1	4	11
Dentalidae indet.	12	5	3		3	1	2		3	4	16	13	4	1		1			5	1			1	1	
Scaphopoda indet.	1		1				1													2					
ANNELIDA: POLYCHAETA																									
Leitoscoloplos pugettensis		1				2							1		1	1			1	5		2	7	3	6
Scoloplos acmeceps																					8	4	4		
Aricidea lopezi	4	2	5	9	4	8	23	35	15	14	14	18	7	33	12	5	13	44	8	7	8	5	11	5	19
-minuta			1			2	1	1				1	1	2	1	1	1	9	1			3			
-neosuecica				1			1													2	1	6	4	2	3
-quadrilobata		1		1			2	1	5	4	3	2		1				3	1						
-ramosa	22	11	13	19	13	14	23	10	18	12	6	11	7	5	3	3	10	3	5	14	8	11	12	9	17
-sp.								1			1	1			4	7	11	6	4	3	5			3	2
Levinsenia gracilis	65	32	46	40	46	42	64	68	47	46	52	27	37	42	28	28	18	22	1	8	3	17	7	2	5
Paraonidae indet.	1	2	1					2		1	2	2		1								2		1	4
Cossura soyeri	9	3	8	12	2	6	1	5	17	19	27	33	33	29	27	28	19	76	1			1	1		
-sp. nov.	88	64	43	43	38	39	20	28	31	25	34	52	64	74	38	43	26	103	1						
-sp.	1	1	2		1	2																			
Apistobranchus tullbergi										3	1														

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B

Appendix 2 (cont.)

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
Laonice cirrata	1				2	1	1	2	5	2	1	2		1			1						1		
Paraprionospio pinnata	32	14	16	12	10	13	4	6	19	12	3	7	11	8	8	9	2	2	3	5	2	5			1
Polydora brachycephala									1															1	
-cf.cardalia			1						2	2										1	2	2		2	
-socialis	1	3							2		1								2	7		2	3	1	2
Prionospio cirrifera	38	6	15	7	31	19	25	20	19	8	6	11	7	8		2		17	45	5	4	6	3	5	2
-steenstupi	4	2	3		5		7	2	26	30	4	12	8	13		14	6	25	34	60	57	67	42	18	55
Spio sp.												1													
Spiophanes berkeleyorum	4	3	4	5	1	1	4	4	17	10	8	4	4	3	1	1		9	5	34	20	32	34	14	30
Spionidae indet.								1	4	4	1	1	1	1	1			4	1	1				4	
Trochaeta multisetosa			6	8	1		7	8																	
Magelona berkeleyi																				3					
-longicornis	4	1				1			3	2	2									3	2	15	4	4	9
Chaetopterus variopedatus																			1		1				
Spiochaetopterus costarum							2	1											9	15	4	8	2	1	5
Cauleriella sp.																			23	7	3	1	2	1	10
Chaetozone spp.	2	2	1			3			1	5		1	1	2					37	27	11	22	20	5	17
Tharyx multifilis	3			2	1														1	1					
-secundus	1						1		1										11	25	15	9	19	8	8
-tesselata	3	1							3	3									3	8	7	3	6	2	5
-sp.	4	5		4	2	3	1		1	2				1	1	2			18	3	2	3	5	1	
Cirratulidae indet.	28	32	25	33	16	19	16	8	28	24	28	49	19	11	12	13	2	2	13	25	13	19	27	6	17
Decamastus gracilis	1	1	1	1	1	3	2		60	72	34	24	10	8	10	8	3	2	96	45	22	57	23	26	35
Heteromastus filiformis	1			2	2		1	1	1	1			1	1											
-filobranchus	24	21	2	1	31	27	1	9	7	18	18	14	5		10	4	1		24	20	12	6	5	3	7
-sp.									1	2	3		1	2	1	1		1	1						
Mediomastus spp.	493		395		321		231		216		151		70		27		6		32		54		79		91
		253		382		342		284		229		194		110		27		14		93		73		39	
Notomastus lineatus																			6	13	3	5	6	3	16
-tenuis																				6	11	5		2	1
Capitellidae indet.	4	1	4			2		1											3	3		1		1	
Asychis nr. disparidentata			1	1	1																			1	
-similis	2		1	3				2	1	4										4	6	2	3	1	2
-sp.			1						1														2	2	
Maldane glebifex					3	1		1	1										9	6	1		1		
Euclymene cf. zonalis									1	1															
Praxillella gracilis	2								1	6	1	2			2	1		2							1
-sp.				1					1	1	1	1		1	1	1									
Euclymeninae indet.	62	41	12	6	17	9	2	27	26	36	16	16		2	1	2	1	1	5	17	13	6	9	6	3
Rhodine bitorquata			1						4	10		1								3	1	1	4		
Nichomache lumbricalis																						2			
Petaloproctus tenuis tenuis																				1					
Nicomachinae indet.															1							2			
Notoproctus pacificus																			1						
Maldanidae indet.	6	4	3	3	1	5	3	2	3	7	2	2	1	1	1				1	4	2	1	2	3	2
Scalibregma inflatum																				2		3			1

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B

Appendix 2 (cont.)

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
Ophelina acuminata					1								1		3	1			1	1		1			
-breviata													1												
-sp.													1			1									
Travisia brevis														1					3	2		1	1	1	
-pupa		1				1		2														1			
-sp.					1	1	1												2		1	1		1	1
Aphroditidae indet.																			3						1
Arcteobea spinelytris																	1	2							
Eunoe uniseriata	1																						1		
Harmothoe lunulata	5	6	4	1	2	1	3	6	1	1	1	4	2		2		1	1	2		1	1	1	4	2
-sp.			1	1		1		1		1								2						1	1
Lepidasthenia berkeleyae	1																								
-longicirrata																			1		3				
Polynoe canadensis													1												
Polynoidae indet.			1	2			1	2					1					1	1	2		1	1	2	
Pholoe minuta	7	2	1	2	1	4		3	3	4	3	1		1				1	4	2	1	2	1	1	1
Eteone longa	3	1		2	2	4			3	1	1				1	1			4	3		2		3	2
Eulalia levicornuta																				2					
-sanguinea											1					1									
-sp.																			1						
Mystides borealis																					2				
Phyllodoce groenlandica	7	5	5	6	2	3	8	6	4	7	6	4	4	10	4	2	2	8	9	9	7	5	3	3	5
Phyllodocidae indet.								2						1					1	1					1
Gyptis brevipalpa	7	4	2	2	4		3	2	1	4	1	2	3	1		1	6	2	1	3	1	3		1	3
Parandalia fauveli																				7	4	1		1	3
Pilargis berkeleyae			1		1	2			3	1				1						2					1
Sigambra tentaculata	2	1				1				1										1			2		
Autolytus cornutus									1																
Exogone gemmifera																			1						
-lourei	8	2	2	1	6	6	1	1	1	2		3	1	1					17	4	11	18	18	14	13
-molesta	2						1	1											11	2			1		
-sp.										1											2				
Pionosyllis sp.																								1	
Sphaerosyllis brandhorsti	15	3		2		1				1	1								40	29	21	18	16	6	23
Syllides longocirrata																			1	5	1				2
Syllis harti																			2						
-heterochaeta																					4				
-nr. alternata	1																		2	1				2	
Eusyllinae indet.																									1
Nereis spp.						2	1		4	2			1	1					3		1	1	1	1	1
Nephtys cornuta	12	4	31	27	9	8	24	26	7	4	9	16	26	45	9	12	7	21	1		1				
-ferruginea	7		1		2	2	4		4	6	1			1	3	2	1	5	2	5	3	4	7	7	4
-punctata		1						1	1	2		1		1				2		1	1				
-sp.	8	12	6	4	3	3	1	3	9	5	7	7	4	1	2	3		1	4	20	13	8	6	6	2
Sphaerodoropsis minuta	1		2	1			1	1	3	1		1	1										1		
-sphaerulifer	9	1	1		2			2	3	5	1	1	1	1								1			

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B

Appendix 2 (cont.)

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
Glycera capitata	9	5	8	10	6	11	11	8	16	14	9	4	4	2	2	4			13	24	6	15	10	12	14
Glycinde armigera	9	5	7	5	5	8	4	10	5	5	3	6	3	5		1	1	4	2	14	5	10	12	7	8
Goniada brunnea	1		1	1	1	2	1				3			1					3	2	3	3		1	4
Onuphis geophiliformis					2									1											
-iridescens	6	2	8	4	8	6	3	1	7	1	1	4	6		5	6	7	8	3	4	2	1	2	1	
-sp.	3	1	5			2		1	2	1			4	3					5	1			3	1	
Onuphidae indet.									1		1	2	2	1											
Lumbrineris bicirrata																				1		1			
-cruzensis	9	4	6	8		4	1	6	13	14	11	18	11	7	3	4	12	8	7	9	2	3	2	2	8
-luti	21	11	10	9	15	16	3	5	11	13	5	9	9	4	6	2	2	3	5	2	3	2	2	1	1
-sp.	28	19	17	19	17	14	17	22	8	10	5	4	5	8	3	6		4	14	5	5	3	4	2	1
Ninoe gemmea	4	5	2		3	4	4	3	3	4	3	4	1	2	1		2		1	4	2	2	3	3	
Paraninoe simpla			3	1	1		1		1				1	1	1	1	2	2							
Drilonereis falcata minor									1										5	1		1	3	1	
-longa																			1	3	2	2		2	
Schistomeringos caeca																				1	1	1			
-longicornis	1												1												
Dorvilleidae indet.	2		1		1	4				1				1						1	2				
Sternaspis scutata	30	32	8	10	21	29	8	12	54	52	48	46	19	13	7	6	4	3	3	3	4	2	3		2
Myriochele heeri																						3		3	
-oculata	109	48	12	23	44	42	59	52	85	120	60	46	10	8	21	22	10	2	14	34	30	35	31	36	26
Owenia fusiformis																			3		2	4	7	4	6
Brada sachalina	3	2	3		8	2	2	2			7	1	4		1	1	1		1						1
Pherusa negligens																				1					
-plumosa																									1
Flabelligeridae indet.					3	1					1														
Pectinaria californiensis	3	8		3	2	3	1	4	2	2	7	16		4	2	3	2		2	4	4	2		1	
-granulata																				1	1	1			
Asage anops												1							1	2				4	
Ampharete acutifrons		3		2	2	1				1					3	3	1			1		1			2
-finmarchia	1	1																						1	
-sp.										1				3											
Amphicteis mucronata		1	4	3		1	9	3							1				1						
-scaphobranchiata												1	1												
Lysippe labiata			1														1		2						
Melinna cristata		1	1	3		2		1		1						1	1		5					1	
Sawytha nr. californiensis																								1	
Schistocomus hiltoni																				1					
Ampharetidae indet.										1									1		2				
Artacama coniferi									1		2	1	1		1									1	
Neoamphitrite edwardsi					1																				
Pista brevibranchiata	1	1	1		1											1									
-cristata	19	6	1	1	11	13			2	1	1						1	10	13	8		6	5	11	11
Proclea graffii																						2	2		
Scionella japonica																			1						

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B

Appendix 2 (cont.)

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
Thelepus setosus																					1				
Terebellidae indet.					1	2	1			1		1				1			2	1				1	2
Terebellides stroemi	6	3	7	5	5	2	3	1	21	24	4	12	5	2		3	1			1	2	1	2	1	1
Trichobranchus glacialis			2	1				1													1				
Trichobranchidae indet.	2			1																					
Chone magna			1																		1			1	
-sp.												1							5	1		2			
Euchone arenae																			9	1	1	2		3	2
-incolor	13	1	88	77	8	13	36	42	3	4	4	5	7	19	2		1	3	6	4	4	1	2	4	5
Sabellidae indet.															1			1			1		2	1	
ANNELIDA: OLIGOCHAETA																									
Limnodrioides cf barnardi	2	1	2		4	3			1			1						1							
-victoriensis					1	2		2		1				3		8	1	1							
-sp.		4	3	1	6	8		1	5			2	6	1	4	2	1	4	1						
Tectidrilus diversus	5		5	6	5	3	3	3	2		2	4	1	2	2				10						
Tubificoides cf. bakeri	1	3																	2						
Oligochaeta indet.	1	1													3				1						
ECHIURA			1	1	1			1																	1
SIPUNCULA																									
Golfingia sp.		1	1																		1			1	
Golfingiidae undet.																									
Phascolion sp.																									2
Phascolosoma sp.																				1					
ARTHROPODA: OSTRACODA	75	20	24	19	32	24	31	42	135	95	121	96	2	1	2	6	1	3	55	18	28	18	10	20	42
ARTHROPODA: CYCLOPOIDA	3	6	30	20	10	12	17	10	5	3	1	1	6	1	2		1	3		1	3				
ARTHROPODA: HARPACTICOIDA																									
Typhlamphiascus cf. typhlops	22	4	14	20	9	30		3	14	13	4	4							2				1		1
Cervinia synarthra			2	1		1		3																	
-tenuiseta			1																						
Acrenhydrosoma cf. perplexum												2		2				1							
Enhydrosoma sp. A		1	2	2	6	3	8	5	1	2			7	3											
Eurycletodes sp. A										1															
-sp. B																									1
Paramannopus sp. A										3				1									1		
Stenhelia sp. A	1			1		1	1	2				2	1									1			
-sp. C			1																						
Diosaccidae indet.						2			1	1				1									2		1
Bradya cf. typica	7		1	1	1	2		3	8	7	9	7	5	3	1	1		1	4		1	1			

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B

Appendix 2 (cont.)

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
Ectinosomatid sp. A	3	2	3	4	4	5	4	9	4	1	1	1	4		1	1		2	2			3			1
- " sp. B																				1					
- " sp. C	1						1			1									1						
- " sp. D																			2						
Harpacticus sp. A	4																1								
Psamis sp. A															1			2							
Dactylopodia sp. A						1			1		1								1						
Tisbe sp. A	6									1								2		1	1				1
Harpacticoida indet.		1	2	1		1						2		1											
ARTHROPODA: MYSIDACEA																									
Pacificanthomysis nephrophthalma																						1			
Pseudomma truncatum																		1							
ARTHROPODA: CUMACEA																									
Eudorella pacifica	9	18	7	2	2	3	3		11	21	19	8	18	7	6	3		3	12	10	7	11	13	16	12
Eudorellopsis longirostris						4				1		1							1					1	
Leucon cf. nasica	7	4	7	6	1	9	4	4	9	7	9	11	6	6	2		1					1	3	3	1
Leuconidae indet.		1					3					3													
Campylaspis cmaliculata																				1	1			2	
-rubicunda										2													1		1
-rubromaculata																			1	1	1			2	
Cumella sp.	2								1											2	3				1
Lampropos serrata																			4	17	16	1	1	10	9
Diastylis bidentata																							2		1
-? hirsuta	1				1					1									1		1				
-paraspinulosa												1							2	1				1	
-pellucida	1				1		2			1	1	2						1						1	
-sp. nov.																					1				1
-sp.										1		1													
Leptostylis macrura					1																1				
-sp. nov.	1									2															
Pentalosarsia declivis																			1	2					
Cumacea indet.							1																		
ARTHROPODA: TANAIDACEA																									
Araphura brevimana	1		17	28	1	2	28	17				3	4	1		3	5	7	7	7	1	5	5	1	7
Leptognathia sp.A								1											4			1		1	
Leptognathia gracilis																			1						1
Pseudotanais sp.A		2	5	5	2	1	46	184	2				5		4	3	19	33	4	16	12	4	3	1	5
Typhlotanais sp.A	2	3	1		1	2	4	1	2			1													
ARTHROPODA: ISOPODA																									
Gnathia sp. A cf. hirsuta																			2						
Haliophasma sp.																					1	1			1
Synidotea sp. A cf. nodulosa																				1			1		1

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B

Appendix 2 (cont.)

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
Caecijaniropsis sp.							2																		
Munnogonium waldronense	6	2	2						2	3	1	1									1			1	
Pleurogonium spp.	1	1			1				3						1					1	1	1	2	1	
ARTHROPODA: AMPHIPODA																									
Rhachotropis sp.	1										1														
Eusiridae indet.		1																							
Synchelidium shoemakeri	2	1	3	1	1	2			4	6	2	2			1				13	4	5	3	4	8	2
Westwoodilla caecula									1											7	4		2		1
Dedocerotidae indet.		2			1	5			3	1	2						1	2	2	2	3		2		1
Harpiniopsis sp.	18	6	7	6	15	8			28	33	28	18	37	13	9	14	1	23	1						
Heterophoxus oculatus	17	8	2	6	7	8	5	5	11	10	9	7	26	12	20	14	4	27	1	1		2	2	2	2
Metaphoxus frequens					2	2	1			2										5	1			1	1
Rhepoxynius variatus	1		1				1													4	5	7	1	13	18
Harpiniinae indet.	3	1								1															
Phoxocephalidae indet.	4				2				2							4	1								
Anonyx lilljeborgi		1																		1	4			1	
Lepidepecreum garthi																			9	1					
Orchomene cf. pinguis										1									3						
-sp.	1									1	1														
Pachynus cf. barnardi			1				1		1	4	1	1					1			4	1	3	2	2	3
Opisa tridentata																			1	2		1			
Lysianassid sp. D							1		2				2												
Tiron biocellata																			1	1	1	1	1		
Synopiidae indet.										3															
Argissa cf. hamata		1		1	1		2		3			2	1												
Nicippe tumida										2		1							3	6	4		16	1	1
Rhynohalicella halona	1				18																				
Pardaliscidae indet.							1																		
Dexamonica reduncans															6				22	3				1	
Ampelisca agassizi	1												1			1	1				1				3
-brevisimulata			1						1										3	4					2
-careyi+ unsocalae	16	11		1	5	2	2	2	10	23	5	9	1	2	1	1	5	4	16	11		2	4	1	6
-hancocki																									1
-pugetica			1	1							1													1	2
-sp.	5		1	1	1					1			1						1		3	4	3	12	12
Byblis cf. mulleni						3	1				2	1									1				
Ampeliscidae indet.	2	1			1		2	3		1		1	1					3		2	4				
Maera loveni	3	5																							
Melita desdichada	1																			3					
-sp.	1																								
Gammaridae indet.					3				2							1									
Photis brevipes	1	1	3		2	6	1		1	11		2							5				3		3
-cf. pachydactyla	2		1	1	2	8						1			2				43	15	18	9		5	1
Corophiidae indet.		1							1			1	1							1		1	6	2	

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B

Appendix 2 (cont.)

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
Aoroides inermis	3	7		1		3						2							3	6	7	2		2	7
-sp.												1			1						1				
?Gammaropsis sp.	1								8	6	3	2	5							1		1	5	1	2
Dyopedos cf. normani				1	2	1				1											1				
Podoceridae indet.									1																
Hyalidae indet.		1																							
Ischyroceridae indet.	3	5			4				1		8	1							2		1				
Stenothoidae indet.	1								4			1			1	1								1	
Amphipoda indet.	3	5	1	1	4					4							2	16	3	3					
ARTHROPODA: DECAPODA																									
Neocrangon communis																								1	1
-resima																						1			
Paguristes turgidus										1									1						
Pinnixa schmitti					1																				
ECHINODERMATA: STELLEROIDEA																									
Luidia foliolata																				1					
Gorgonocephalus eucnemis													1												
Ophiura luetkeni					1				1	1		1										3	18	2	
-sarsi	3			2		1	3	19	2	1			1						3	1	6	1	7	3	7
-sp.																			5						
Amphioplus macraspis							3	1	1	1														1	
-strongyloplax		1	2	1	3	1	1	6	2						2	1	2	1		2	5	1	3	2	2
-sp.					1																				
Amphiuridae indet.	4	1	1	1					1		1		1				1		2	2	2	2		2	1
Ophiuridae indet.	6	1	5	2	5	2	5	2	3	2	1	2	1	1		3	2	1	1	5	2	3	6	1	4
ECHINODERMATA:ECHINOIDEA																									
Brisaster latifrons	5	3	2	1				4			2	2	3		1			1	1			1		4	1
ECHINODERMATA: HOLOTHUROIDEA																									
Pentamera populifera																				1		1			
-pseudocalcigera		1							3	1	1	1	2	2			1							1	1
-sp.													1		1		1		3					1	
Phyllophoridae indet.												1													
Molpadia intermedia	1	1	2	2			1	3								1									
-sp.	1				1																				

STATIONS:	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	D1		D2		D3	
REPLICATES:	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B

Appendix 3. Numbers of organisms occurring in grab samples at stations occupied during Cruise 2, stations A-C.

INTERPRETIVE NOTES

1. Numbers in this table are the totals for all "water", "subcore" and "macro" samples at each replicate of each station.

2. Values for stations C4-A, and C4-B are not comparable to the rest. At these stations, only six subcore samples were taken, but nine were taken at other stations.

Appendix 3. Numbers of organisms occurring in grab samples taken from silt/clay substrates during Cruise 2.

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
CNIDARIA:CERIANTHARIA				1							2									
NEMERTEA	4	3	13	3	3	5	2	7	2	1	2	3	3		3		4	3	3	3
KINORHYNCHA																				
Kinorhynchus spp.	17	14			6	7			11	35	4	1		3	20	33				1
Pycnophyes sanjuanensis	3	1				2			13	14	6		1	1		7				
MOLLUSCA: APLACOPHORA																				
Chaetoderma argenteum	2		2	2		1	6	1			1	4	2	11	1		3	2		
-sp.A	1	2	4		1	2	2		1	3			1	1	3		3	3		
-undet.			1				1				2						2	2	3	5
MOLLUSCA: GASTROPODA																				
Bittium vancouverense																			2	
Solariella varicosa	11	5			3	2						1	1			4				
Polinices pallidus	1		1					1	1	1				1	2	1				
Cryptogemma adrastia																1				
Mohnia frielei																	1	1		
Plicifusus brunneus														2						
Amphissa columbiana																			1	
Nitidella gouldi		1													1	9				
Odostomia avellana	3	1	3		4	2		1	7	2	1	2	2	2		1		1		
-hypatia		1									2	2		1						
Turbonilla aurantia	4	1			1			1	3	10	5	7		1		1				
Acteocina culcitella																1				
Cylichna attonsa		1																		
Philine polaris	1																			
Volvulella cylindrica						1														
MOLLUSCA: BIVALVIA																				
Nucula belloti	1	5	3	1	1	1	2		25	8	8			4	1	3		1		3
Nuculana sp.							1	3	1	1	2				3				1	1
Yoldia scissurata	7	15	8	4	1	10	16	11	5	3	2	2	1	3	1		4			
-thraciaeformis	5	2	6	11	3	7	20	6		5	7	5	1	4	3	4	5	1		
-myalis	1		3				2	1												
Huxleya munita		1																		
Crenella decussata																			2	
Musculista senhousei																				1
Pectinidae sp.		1																	1	
Lucinidae sp.	4	2		1	2	3	3	9	14	21	5	11	5	9	7	7				
Adontorhina cyclia	1	1	5	2	3	11	13	10	6	2	5	11	16	17	13	13	26	9		
Axinopsida serricata	3	1	3	2	1	1	15	4	22	19	3	5	6		4		2	2		
Thyasira gouldi									1		2							1		
-sp.	3	1					14	14	4	9	1	5	10	10	3	13	1	5		

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B

Appendix 3 (cont.)

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Thyasiridae indet.	2	2	3	4	1	2	8	13					3		1	1	5	5	1	5
Mysella compressa	3	2		19		7	7						3							
Cyclocardia ventricosa	1	3	1		1	1			1		2	3	1	2	1				3	
Nemocardium centifilosum					1														2	3
Macoma carlottensis	4	6	7		3	1			6	14	10	3			6					
-elimata		3		2	1			2	2	5					2	17	2			
-sp.	14	10	5		19		3		31	25	41	40	11	53	22	18				
Compsomyax subdiaphana	1					1				6			1		1	2				
Psephidia lordi								1												
Hiatella arctica			5																	
Lyonsia bracteata							1			7	28									
Pandora filosa										2										
-sp.		1																		
Cardiomya californica	1	3	1						1											
-pseutes					1															
Bivalvia indet.	7	17	10	7	6	31	27	84	1	4	4	2			12	28	6	6	22	109
MOLLUSCA: SCAPHOPODA																				
Cadulus aberrans	1	1	2										4	1						
-californicus											1						4			
-tolmei	1		4	6	2	2	6		2	1	15	23	7	6	11	6	14	14		
-sp.		1	1		1	2	1	6					1	1			2			
Pulsellum salishorum	1					4	18		1		1							1		
Dentalium rectius	3	3	1		2	1		1	3	3	6	4	4	2	1	2	1	1		
Scaphopoda indet.			2		2		8			2	1				2				1	2
ANNELIDA: POLYCHAETA																				
Leitoscoloplos pugettensis					1	1				1										
Aricidea lopezi		2	5	2	7	3	57	36	6	8	8	25	7	16	18	22	41	34	12	14
-minuta	1		1			1	2		2			2	1	5	5	3	3	3		2
-neosuecica				1						1									3	2
-quadrilobata						1	1		4	5		1	1	2						
-ramosa	9	18	12	9	22	29	20	5	7	12	3	16	14	13	10	6	6	13	6	7
-sp.				1	2		5	3	1	2		1	3	1	2		8	5	4	5
Levinsenia gracilis	33	37	55	42	50	44	109	60	28	40	27	34	41	48	34	37	29	24	1	9
Paraonidae indet.								1								1		3		2
Cossura soyeri	9	11	13	9	16	8	20	17	8	10	17	47	31	29	29	26	28	38	4	4
-sp. nov.	37	50	39	26	44	41	38	20	17	23	48	82	67	65	46	31	33	34		1
-sp.			1	2	3					2		1			1		3	2	1	
Apistobranchus tullbergi					1														1	
Laonice cirrata	2		1	1		2	1	3	3	1		3	2	2	1	3	4			
Paraprionospio pinnata	24	15	13	8	11	9	2	1	23	12	1	4	8	10	7	6	4	1	1	
Polydora brachycephala																			1	
Prionospio cirrifera	4	6	5		26	10	73	8	18	13	13	7	7	15	8	18	18	9	8	8
-steenstupi	1		7	2	13	11	14	16	24	20	14	15	28	27	33	24	16	13	53	7
Spio sp.	1						1												1	2

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B

Appendix 3 (cont.)

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Spiophanes berkeleyorum	2			2	1	1	4		5	6	3	1	1	2	1	3	2	2	1	7
Spionidae indet.	1	1		1					2	2					1	1		2	2	
Trochaeta multisetosa			4	6	3		5	4												
Magelona longicornis	2									1										2
Spiochaetopterus costarum		2	1		1	2	1						1					1	3	1
Chaetozone setosa		1			3	2	2	2	4	3		4		1	2				11	25
Cirratulus cirratus																			1	
Tharyx mulifilis																				1
-tesselata	3								1							1			5	8
-sp.		2	1	1	1	1				2	1	2	1	1					2	2
Cirratulidae indet.	29	24	15	11	30	24	18	13	24	39	39	46	26	50	20	21	10	3	13	21
Decamastus gracilis	12	11			16	11	4	15	28	12	2	10	11	9	12	8	2	1	38	23
Heteromastus filobranchus	5	11	3		17	16	4	5	17	16	6	12	11	10	2	5	8	2	16	10
-sp.	1							3	3	1	1	1	1	1				1		1
Mediomastus ambiseta	153		213		236		381		64		54		71		43		18		103	
		215		92		227		263		118		155		84		32		12		76
Notomastus lineatus																			3	
Capitellidae indet.	1	1	2							1									2	
Asychis similis			1	1				1			1								2	1
-sp.	1			2		1	1	4			1									
Maldane glebifex	4			1	9		1	9	3											
Euclymene cf. zonalis				1																
Praxillella gracilis			1					1					3	1		1	2		1	
-sp.		2				1			1		1	1								
Euclymeninae indet.	17	33	8	5	21	19	4	14	15	7	3	7	4	5	4	3			10	11
Notoproctus pacificus																			9	18
Petaloproctus tenuis																			2	3
Nichomachinae indet.																				1
Rhodine bitorquata	3		1				2	2	1	1	1								8	3
Maldanidae indet.						1				1		1				1	1		4	4
Scalibregma inflatum																			2	2
Ophelina acuminata								1								1		1		
-breviata															2		2		1	
-sp.				1											1					
Travisia pupa			4		1	3						1	1					1		
-sp.		1										2								1
Aphrodita japonica									1											
Aphroditidae indet.													1		1				1	1
Arcteobea spinelytris														1			1	1		
Eunoe senta																			1	
Gattyana treadwelli															1					
Harmothoe lunulata	1	3	2	3		4	3	3	1	2	1	3	2	1	2	2	2	2	2	
-sp.		1												1						1
Lepidasthenia berkeleyae						1														
-longicirrata																			1	

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B

Appendix 3 (cont.)

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Polynoe canadensis											1									
Polynoidae indet.	3	1		1	1		2	2		2	2			3				1		1
Pholoides aspera															1		1		33	16
Pholoe minuta	2	5	4	1	1	5	6	1	2	6	1	2	1	4		1	2			1
Eteone longa	3	1	4		4	4	4	3	1	3	2		1		1				2	1
Eulalia levicornuta			1					1		1										
Mystides borealis						1														
Phyllodoce groenlandica	2		1		1	3	1	1	4	1		4		1	1	1	1	1		
Gyptis brevipalpa	1	1	2		3	1	5				2		4	3	1		3		1	1
-sp.					1	4														
Pilargis berkeleyae		1	1	2	1	1		1	2								3			
Sigambra tentaculata						2					1									
Eusyllis magnifica																			1	
Exogone gemmifera																			8	2
-lourei	8	8	1		4	4		1	1		1			1					37	70
-molesta		2						1											6	8
-sp.																			2	
Odontosyllis phosphorea																			1	
Pionosyllis uraga								1												
-sp.																				2
Sphaerosyllis brandhorsti	1						2												18	30
Syllides longocirrata																			1	1
Syllis cf. alternata																			3	3
-harti									1										4	2
-sp.																			1	2
Nereis sp.						2				1		1	1			1	1		3	2
Nephtys cornuta	8	12	27	19	15	14	71	15	7	8	26	11	17	30	19	10	35	39	3	3
-ferruginea		2			2		1		4	2	1	1	3		2	3		1	2	2
-punctata	3	2				1	2	1	1	3	1				1	1	1			
-sp.	2	4	2	2	3		1	2	1	9		3	3	2	1	5		2	2	1
Sphaerodoropsis minuta			1		2	2	1								1					
-sphaerulifer	3	4			2	7			1	3				2	4	5			1	
Glycera americana			1										1							
-capitata	10	2	7	5	8	11	11	7	6	4		4	6	3	5	3	8	4	9	4
Glycinde armigera	1		3	1	4	1		6	3	1	4	3	2	3	4	5	3	6	3	3
Goniada brunnea	2		5	2	2		3	1			1			2	1		1	1	1	
Onuphis conchylega																			1	
-geophiliformis											1	2		1			1	1	1	
-iridescens	4	3	9	8	4	5		2	9	2	6	3	9	4	2	3	6	5	5	3
-sp.						2			1					1						
Onuphidae indet.										1										
Lumbrineris bicirrata					1			1	1						1				6	
-cruzensis	3	4	8	4	3	2	7	8	9	8	3	9	6	11	7	4	21	17	10	2
-luti	15	12	17	9	18	9	10	7	3	9	2	4	9	2	5	11	2		5	4
-sp.	10	10	17	10	12	11	13	16	8	3	11	9	5	8	22	12	5	3	13	16
Ninoe gemmea		1	3	4	1		2	7	5	9	1			4			2		2	

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B

Appendix 3 (cont.)

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Paraninoe simpla				1			1	1					3				1	1		
Drilonereis cf. falcata																			2	
-falcata minor									1										3	
-longa																1				1
Ophryotrocha sp.							1													
Schistomeringos caeca					4			2			2								1	
-cf. longicornis		1													8			1		
Dorvilleidae indet.	1	1				1	3					1	1	1						1
Sternaspis scutata	24	21	6	6	19	11	16	13	58	50	40	51	27	41	17	11	1	2	1	2
Myriochele oculata	134		16		103		251		86		19		54		247		101		43	
		111		2		120		242		48		31		55		213		53		34
Owenia fusiformis																				1
Brada sachalina	3	1		1	6	3	5		1		2		1					2	1	
Pherusa negligens				1															1	
-plumosa					1														1	
Pectinaria californiensis	3		1	1	3	4	4	4	2	3	21	5	3	3	2	3	2	1		
-granulata																			1	
Ampharete acutifrons	4	5	2	4	14	18	15	2	1	2	10	7	11	7	24	20	2	9	3	1
-sp.															1					1
Amphicteis mucronata			2	2	2	2	5	6	2				1		1	2		1	2	1
Lysippe labiata																			2	
Melinna cristata	1		1	1		1		1				1		3		1	5	4	1	
-elisabethae																			1	
Samytha cf. californiensis																			1	
Schistocomus hiltoni																			1	1
Ampharetidae indet.	3		3		1	2	5	5							5	8	1	1	1	2
Artacama coniferi											2	1		1						
Pista brevibranchiata					3								2						1	1
-cristata	13	16	2	2	11	9	1		4	2		2	2	2					20	5
-moorei	1																			
Polycirrus sp.III																			2	
Proclea graffii						1		1							1					1
Scionella japonica																			2	
Thelepus setosus																			3	
Terebellidae indet.	1																			
Terebellides stroemi	2	2	3	3	3		7	8	8	5	3	8	1	6	2	3			8	2
Chone magna						1														
-sp.	1	1			1														2	5
Euchone nr. arenae																			2	3
-incolor	4	12	36	11	59	33	76	39	2		13	22	7	9	43	15	6	5	11	14
Megalomma splendida						1													3	
Sabellidae indet.		1		2							8				4	1	1		1	2
ANNELIDA: OLIGOCHAETA																				
Grania sp.																	1			1

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B

Appendix 3 (cont.)

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Limnodriloides cf. barnardi		3	1	1	3	9	4										1			
-victoriensis			1		3										1					
-sp.	1	2	2	1	4	6	2	3			2	1	2		9		4			
Tectidrilus diversus	4	1			17	20	15	11			1		8	3						
Tubificoides cf. bakeri	1	2															1			
ECHIURA																				
Nellobia eusoma			1																	
Arhynchite sp.														1						1
SIPUNCULA																				
Golfingia sp.		1		2	1	7														5
Golfingiidae			1			2					1				2				1	8
Phascolosomatidae																				2
Sipuncula sp.					2						1									2
ARTHROPODA: OSTRACODA	17	42	18	26	29	53	68	61	231	206	147	82	24	27	19	42	31	13	59	87
ARTHROPODA: CYCLOPOIDA	2	4	15	14	34	23	6	5	2	1	1	9	14	7	1	6	29	21	12	4
ARTHROPODA: HARPACTICOIDA																				
Typhalamphiascus cf. typhlops	8	5	5	11	33	7	3	18	6	18			1	1			11		5	9
Ancorobolus sp. A								1												
Cervinia synarthra		1	4			2	6	5												
-tenuiseta			1		1															
Acrenhydrosoma cf. perplexum		2						1										1		
Enhydrosoma sp. A	1	1	3	1	1	1		5	2	3	1	1			5	7	5	1		1
Eurycletodes sp. A									1											
-sp. B						1														1
Bulbamphiascus imus				2			1								1				1	1
Stenhelia sp. A			1		3		4	2				1		4		1	1	1	1	
-sp. B		1		2		3	2						1				1			
-sp. C			1			2					1		1				1	1	2	1
Bradya cf. typica	2	6	3	1	4	3	2	3	10	4	11	13	4	15	17	29	5	7	4	2
Ectinosomatid sp. A	1	6	1	2	7	4	2	3	3	2	3	5		5	7	4		4	6	2
-sp. B											2	1		4	2	4		1		
-sp. C				2	2		1		1	1				1		4			3	1
-sp. D																1				
Psammis sp. A																	5	3		
Tetragoniceps sp. A																	4	1		
Dactylopodia sp. A										1						3	1			
- sp. B												1								
Tisbe sp. A	1	1			7	7		1	5	3	5	1	1		8	4		1	4	
Harpacticoida indet.		1	1	1		3	1		1		1			1	1		5	1	9	1

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B

Appendix 3 (cont.)

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
ARTHROPODA: MYSIDACEA																				
Pseudomma truncatum						2												1		
Meterythropos robusta			1																	
Pacificanthomysis nephropthalma						1														
ARTHROPODA: CUMACEA																				
Eudorella pacifica	7	3	16	6	2	2	2		17	4	4	3	34	47	24	14			2	1
Eudorellopsis longirostris																			2	3
Leucon cf. nasica	3	3	9	10	5	13	5	6	9	8	6	8	6	9	4	4	11	8	3	9
Campylaspis rubicunda	1		1			3	1			1		1						1	1	
Cumella vulgaris											1									1
Lamprops serrata			1						1											
-sp.											1									
Diastylis bidentata																				1
-hirsuta							1		1	1			2	1					1	
-paraspinulosa	1	1																		
-pellucida	1		1	3	1	1	1	1	3		2	1				5				
-sp.			2			1	1				1							1		
Leptostylis sp. nov.	3			1		1			1											
-sp.								1												
Pentalosarsia declivis																				1
ARTHROPODA: TANAIDACEA																				
Arathura brevimana	2		1	10	5		22	10	2	1	1	6	2	4			15	6		5
Leptognathia gracilis																			2	
-sp.A							1	3							1					2
Typhlotanais sp.A		1			1	1			1		6	5		1	1	1		1		3
Pseudotanais		1	6	12	4	1	11	8	3	3		11	4	9		1	53	79	32	59
ARTHROPODA: ISOPODA																				
Gnathia cf. hirsuta																				1
-sp. B																			3	
Rocinela cf. belliceps								1							1				1	
Synidotea sp. A						1														
Caecijaniropsis sp. nov.															2		2			
Munnogonium spp.	5	3				2	1	1		1									2	2
Pleurogonium sp. nov. A					2	7		3							3	1				2
ARTHROPODA: AMPHIPODA																				
Rhachotropis sp.																1				
Monculodes sp.				1	2			1								1		1	1	2
Synchelidium shoemakeri	4	2	4	2	1	3	2		2		2	7			5				8	11
Westwoodilla ceacula	1		4		2							2		2					3	6
Oedocerotidae indet.		1	3	3	1	3	3		1	1			1		1	1				
Harpiniopsis sp.	6	17	9	10	13	6	3	4	20	17	5	14	29	33	31	20	18	16	1	

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B

Appendix 3 (cont.)

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Heterophoxus oculatus		2	7	5	7	9	9	5	19	20	7	6	23	26	18	18	21	10	1	1
Metaphoxus frequens	2	1				1													4	1
Paraphoxus oculatus									1				1		1				1	
Phoxocephalidae indet.			1								1	1								
Lepidecreum garthi												1								
Lysianassid sp. D											3	6	1	3		1				
Orchomene cf.pinguis			8		3				1											
Pachynus cf. barnardi													2	1		1				
Prachynella lodo						2														
Syrrhoe longifrons													1	4			2	2	3	1
-sp.															1		1	1		
Tiron biocellata																		1		
Nicippe tumida	1												1	2		1	1	1	1	1
Pardalisca cf. cuspidata																			3	
Pardaliscella symmetrica	3											1								
Pardaliscidae indet.																	1			
Ampelisca agassizi					2	1														
-brevisimulata														1						
-careyi + unsocalae	6	8	6	5	12	6	3	4	15	25	1	5	4	10	2	7	9	1		1
-hancocki	1								2				2							
-pugetica	1													2	1		1	1		
-sp.	5	3							1								4			
Byblis cf. mulleni										3										
-sp.													1							
Ampeliscidae sp.	1	1							1											
Gammaridae sp.		1																		
Photis brevipes	2				2	7				1					1					1
-cf. lacia	1		2			5														
-sp.	2	2			13	12			1				5						7	15
Aoroides inermis	5	1			13	11			4	1										
-sp.	2	1			3					2										1
Dryopedos sp. A						1			2						1					
?Gammaropsis sp.									6	11			5	9		1				6
Ischyroceridae sp.						1													1	
Corophiidae sp.									4	3		5		5						
Stenothoidae sp.	1	1				1				3		3	1		2	1		1	6	2
Amphipoda indet.						5		1	3		1								1	
ARTHROPODA: EUPHAUSIACEA																				
Euphausia pacifica	1			1		1										1	1			
Thysanoessa spinifera			2	6	2	3	1	1						1		1	1			
Euphausiacea indet.			1	1											1	1	3	1		
ARTHROPODA: DECAPODA																				
Eualus avinus		1		3				1		1						2		2	1	1
-pusiolus		1																		

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B

Appendix 3 (cont.)

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Lebbeus grandimanus																			1	
Spirontocaris holmesi	2																			
Pinnixa schmitti												1							1	
Brachyura indet.							1													
ECHINODERMATA: STELLEROIDEA																				
Ophiura luetkeni	6	1								1									2	
-sarsi		1			1	1	11	12	1	1					4				2	
Amphiolpus macraspis						1	7		1		3		1	2		1				
-strongyloplax		3	1	3			1			2		5		2				3	1	
Amphiuridae indet.		2	1			1	3	4	1					1	1	2	1		1	
Ophiuroidea indet.	3	15	8	5	8	4	5	6	7	6	5	3	7	2	8	15	1	3	13	12
Amphiopholis pugetena																1				
ECHINODERMATA: ECHINOIDEA																				
Brisaster latifrons	10		3	1	1	3	3	3		2	3	2		2	1	1	2	3		
ECHINODERMATA: HOLOTHUROIDEA																				
Pentamera pseudocalcigera		3				2		1			3	1	3		3	1		2	1	1
-sp.	1		2			1		2			1					1				
Molpadia intermedia	1		3		2			1	1	1			1	1	1					
Molpadiidae indet.					1		2	3	2											

	A1		A2		A4		A5		B1		B2		B3		C1		C2		C4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B

Appendix 4. Numbers of organisms occurring in grab samples taken from sand substrates during Cruise 2.

INTERPRETIVE NOTES:

1. Numbers in this table are the totals for all "water", subcore and "macro" samples at each replicate of each station.

2. Values for B4-A, B4-B and C5-A are not strictly comparable to the rest because nine subcores were taken at these stations, while only six subcores were taken at the others.

FINAL UPDATED VERSION: JANUARY 25, 1987

Appendix 4. Numbers of organisms occurring in grab samples taken from sand substrates during Cruise 2.

	B4		C5		D1		D2		D3		D4	
	A	B	A	B	A	B	A	B	A	B	A	B
KINORHYNCHA												
Kinorhynchus cataphractus	1											
Kinorhynchus ilyocryptus		3	1	1	1	1	4	3	2	4	1	3
Kinorhynchus sp.										2	2	
Pycnophyes sanjuanensis	1				1		1		1		1	
MOLLUSCA: APLACOPHORA	6	6	2	1	3	2	8	7	1	1	7	6
MOLLUSCA: GASTROPODA												
Solariella varicosa						2	2	1				
Alvania rosana								1				
Polinices pallidus						1	1			2		
Plicifusus brunneus							1					
Nitidella gouldi					3	4	1	2				
Admete cathouyi						1	2					
Antiplanes voyi											1	
Ophioderaella cancellata							1					1
Ophioderaella incisa							1					
Odostomia avellana					1		1			4		
Turbonilla aurantia										1		
Actoecina culcitella							1			1		
MOLLUSCA: BIVALVIA												
Nucula tenuis							2	1	1			
Nucula sp.							1	1	1			
Nuculana aniata											1	
Nuculana extenuata					1						1	
Nuculana hindsii												1
Nuculana minuta			1	2				1			1	1
Nuculana navisa				1								
Nuculana sp.								1				
Yoldia martyria	1	2	1									
Yoldia scissurata	1	2									1	
Yoldia thraciaeformis		1			2							
Yoldia sp.					1	2						
Huxleyia munita					15	34	23	12	4	24	15	12
Crenella decussata				2		2	2		1	3		
Musculus sp.										1		
Delectopecten vancouverensis				1								
Pecten caurinus												2
Lucina tenuisculpta	7	6	23	19							1	
Lucinoma annulata			1		2	1	4			1	4	2
Lucinidae sp.					2							
Diplodonta orbella												1
Adontorhina cyclia	10	36	32		26	36	98	45	1	38	32	48
Axinopsida serricata	16	1										
Thyasira flexuosa			24	7	1	2	5	4		2	2	3

Appendix 4 (cont.)

	B4		C5		D1		D2		D3		D4	
	A	B	A	B	A	B	A	B	A	B	A	B
Mysella compressa			5	3							4	3
Mysella tumida	7		3	4		2				4	1	
Cyclocardia ventricosa		1					6	2		2	2	16
Tridonta rollandi												7
Nemocardium centifilosum			1	4		1	1				1	
?Solen sicarius												1
Macoma alaskana				9	1	7	5			5		
Macoma carlottensis			1	2								2
Macoma eliminata	1	1		6	2	4	2	5				7
Macoma sp.			2	17	19		11	10				
Tellina carpenteri					16	23	13	2	1	6		
Tellina modest			4	9							13	5
Tellina sp.						1						
Compsomyax subdiaphna						2	5				1	2
Psephidia lordi				9		2		4			2	6
Cooperella subdiaphana				4								
Lyonsia bracteata				1								
Lyonsia sp.						1	4					
Pandora filosa				2		1	3	4				2
Pandora grandis												1
Cardiomya olroydi		1										
Cardiomya pectinata												1
Bivalvia indet.					4	3						
Bivalvia juv.					65	75	5	37	0	76		
MOLLUSCA: SCAPHOPODA												
Cadulus aberrans							1					
Cadulus californicus										1		
Cadulus tolmei	1					1	1			3	2	1
Pulsellum salishorum				1				2				5
Dentalium rectius	1	1	2	2						2	2	4
Dentalium sp.		2							1			1
Scaphopoda indet.		1	1	3	5	7	1	1	3	2	2	1
ANNELIDA: POLYCHAETA												
Leitoscoloplos pugettensis			1									
Orbinia felix						1						
Scoloplos acuteceps	1		3	3	7	13	9	6		4	2	2
Aricidea lopezi							2			4		
Aricidea minuta	3	3	2	1	1	1		2		5	3	1
Aricidea neosuecica			5	9	3			4		1	1	2
Aricidea quadrilobata							1					
Aricidea ramosa	7	11	11	3	11	8	5	13	5	13	15	8
Aricidea suecica	4	5	7	4					1	1		
Aricidea sp.					3	7	3	7	7	5		
Levinsenia gracilis	22	34	1	2	7	9	3	13	8	11	26	21
Paraonidae indet.			8			1					4	6
Cossura soyeri	11		2		1	1	1	1			2	3
Cossura sp. nov.	39		1	1								
Cossura sp.					1							

Appendix 4 (cont.)

	B4		C5		D1		D2		D3		D4	
	A	B	A	B	A	B	A	B	A	B	A	B
Apistobranchus tullbergi			1		1	1				1	1	2
Apistobranchus sp.				1	1		1					
Laonice cirrata	6						1					
Paraprionospio pinnata	21	18	1		1	2	5	5			17	9
Polydora brachycephala						1					1	1
Polydora cf. cardalia		1			1		1					2
Polydora socialis							1					
Prionospio cirrifera	22	11	8			5			2	5	14	4
Prionospio steenstrupi	15	18	36	22	25	24	13	20	9	15	6	6
Prionospio sp.						1						
Spio filicornis										1		
Spiophanes berkeleyorum	5	2	4	3	6	18	16	18	4	16	10	14
Spiophanes sp.									1			
Spionidae indet.				1								
Magelona berkeleyi								1				
Magelona longicornis					2	1	7	6	2	5	21	8
Spiochaetopterus costarum		2	9	4	1	2	7	9		12	1	10
Chaetozone acuta			2		5	14	2	6	3	3	1	1
Chaetozone setosa			2	1	4	4	4	8		3		4
Chaetozone spinosa			2	9	1		1	1	1	1	2	4
Chaetozone sp.	1	10	16	14	7	11	8	6	5	7	7	6
Tharyx secundus			15	9	5	15	8	15	6	11	16	15
Tharyx tesselata	3	3	6	7	3	7	7	7	2	11	13	17
Cirratulidae indet.	7	12	13	10	17	5	16	21	4	19	2	8
Decamastus gracilis	5	3	91	89	28	50	45	31	17	36	29	44
Heteromastus filobranchus	3	5					1					
Mediomastus californiensis			2				5				2	
Mediomastus sp.	30	35	37	12	40	50	56	89	61	59	64	62
Notomastus lineatus			5	7	12	12	11	4	1	8	9	9
Notomastus tenuis					7	10	5	8	1	7		
Maromastus sp.				1								
Capitellidae indet.					2		1		1	2		
Asychis nr. disparidentata						3	3	3		5		1
Asychis similis				1								3
Asychis sp.							1					
Maldane glebifex			19	5	1			1			4	4
Maldaninae indet.						3		3				
Clymenura columbiana							2					
Clymenura sp.				1								
Euclymene cf. zonalis								1			1	
Euclymene sp.		2	6	2							2	1
Praxillella affinis pacifica												2
Praxillella gracilis				1		1		1				1
Praxillella sp.		1	4	2					1		4	3
Euclymeninae indet.	3	1	5	2	3	4	10	4		5		2
Nichomache lumbricalis			4	2			1	2			2	2
Petaloproctus tenuis										1		
Micromaldane ornithochaeta			1									
Rhodine bitorquata				1			2	1	1		3	1
Lumbriclymeninae indet.					1					4		
Scalibregma inflatum				1								

Appendix 4 (cont.)

	B4		C5		D1		D2		D3		D4	
	A	B	A	B	A	B	A	B	A	B	A	B
Ophelina acuminata	3		8			1		1				
Ophelina breviata								1				
Travisia brevis			17	13	5	7	2	1		2	1	
Travisia pupa	1	1										
Travisia sp.			2	1			1		2			1
Aphroditidae indet.									1			1
Actinoella macrolepida								1				
Actinoella sp.							1					
Eunoe depressa				1		1						
Polynoidae indet.	3		2	6	5	5	3	2	2	6	3	1
Pholoe minuta	2	7	5	1	9	2		3	1	4	7	4
Eteone longa			1	2	1	1				1		1
Eteone sp.						1		1				
Eulalia sp.									1			
Phyllodoce groenlandica		1	1	3			2	2		1	3	2
Phyllodoce sp.	1							2				
Phyllodocidae indet.				1							1	1
Gyptis brevipalpa		2				7		1			3	1
Gyptis sp.							1		1			
Hesionidae indet.	3							1				
Parandalia fauveli		1			3	1				1		
Pilargis berkeleyae										1		1
Exogone gemmifera												
Exogone lourei			10	2	1	3	7	9	2	6	16	41
Sphaerosyllis brandhorsti			50	3	10	11	2		2		8	17
Sphaerosyllis sp.				1								
Syllis cf. alternata											1	1
Syllis cf. elongata				2		1		1			1	1
Syllis sp.									1			
?Typosyllis indet.								2				
Syllidae indet.			3		1	1		1		1		1
Nereis procera						1						
Nereis zonata		1	3			1		1	2			1
Nephtys assignis											1	
Nephtys cornuta	11	16	1	1		3			1		4	3
Nephtys ferruginea	2	4	6	4	4	6	7	2		2	9	4
Nephtys punctata	3	2	1				1					
Nephtys sp.					1	1		3	2			
Sphaerodoropsis sphaerulifer					1	1					1	4
Sphaerodoropsis sp.						1						
Sphaerodoridae indet.			2								2	
Glycera capitata	5	4	6	7	7	4	7	11	3	8	6	8
Glyceridae indet.			1									
Glycinde armigera	2	1	5	3	2	2	3	2	3	1	5	1
Goniada brunnea		1		1		1	2				1	
Goniada maculata			1	2								

Appendix 4 (cont.)

	B4		C5		D1		D2		D3		D4	
	A	B	A	B	A	B	A	B	A	B	A	B
Glyceroidea indet.										1		
Onuphis geofiliformis					1	1				1		
Onuphis iridescens	6	8	2	2	1	3	6	1		5	2	2
Onuphidae indet.		1										
Lumbrineris bicirrata												1
Lumbrineris cruzensis	15	4	4	6	1	1	6	4		6	5	4
Lumbrineris luti	7	6	8	3	7	4	1	6	4	6	13	10
Lumbrineris sp.	1	2	4		1	6	6	5	2	3	2	4
Ninoe gemmea	4	2	1	2	7	5	7	6	1	6	5	4
Paraninoe simpla						1		3		1		
Drilonereis falcata minor			3		1	2	7	4		2	1	2
Drilonereis longa				1								
Schistomeringos caeca										1		
Schistomeringos rudolphi											1	
Dorvilleidae indet.											1	
Sternaspis scutata	15	8	2	1	6	2	5	5	1	4	4	3
Myriochele heeri			9	20	0	24	15	17	3	23	1	4
Myriochele oculata	6	14	135	101	19	59	92	145	51	100	65	169
Owenia fusiformis			5	2		4	15	6	4	9	5	19
Brada sachalina		4			1		1			1		
Pherusa plumosa								1				
Flabelligeridae indet.			1					1		1		
Pectinaria californiensis		1					2			1		
Pectinaria granulata			1			2	1		1			
Pectinarriidae indet.								1				
Ampage anops											1	1
Amapharete acutifrons	6	1	3	4	3					1		
Amapharete sp.							1	1				
Amphicteis mucronata			1									
Amphicteis scaphobranchiata		1										
Melinna cristata	1	3	5	2			1	1				1
Melinna elisabethae							1	1				
Schistocomus hiltoni						1						
Ampharetidae indet.			4			1	1	4			2	
Artacama coniferi					1							
Pista brevibranchiata		1										
Pista cristata	4		3	4	1	6	18	9	2	10	11	3
Pista moorei			1			1						
Pista sp.									1			
Proclea graffii							1					
Terebellidae indet.	1		2	4					1			
Terebellides stroemi	1	1		1		2	3	1		1	2	5
Chone sp.		1	7	1	1	2				2		6
Euchone nr. arenae	1	11	5	3	1	2		2		1		
Euchone sp.								1				
Megalomma splendida											1	
Sabellidae indet.	2	7	12	5	1		2	1	1	2	1	

Appendix 4 (cont.)

	B4		C5		D1		D2		D3		D4	
	A	B	A	B	A	B	A	B	A	B	A	B
ANNELIDA: OLIGOCHAETA												
Limnodriloides cf. barnardi		1										
Limnodriloides victoriensis		1										
Limnodriloides sp.		2										
Tectidrilus diversus		1										
Tubificoides cf. bakeri												1
ARTHROPODA: MYSIDACEA												
Inusitatomysis insolita			1									
Pseudomma truncatum		1										
ARTHROPODA: CUMACEA												
Eudorella pacifica	18	26		1		2						
Eudorella sp.						2			1			1
Eudorellopsis longirostris			1								1	
Leucon cf. nasica	1	1	1									
Campylaspis canaliculata			1		1						2	
Campylaspis rubicunda			1									
Cumella vulgaris					1	2			2		2	
Hemilamprops californica								1				
Hemilamprops gracilis			1					1				
Lamprops serrata				1	47	7		5	18	13	8	6
Lamprops sp.					47	27	1	5	6	17	11	6
Diastylis bidentata			2		2	2	5			2	2	1
Diastylis hirsuta								1				
Diastylis paraspinulosa				1	1		2				3	
Diastylis pellucida												1
Diastylis sp. nov.	1						1					
Diastylis sp.								1				
Leptostylis macrura			1									
ARTHROPODA: ISOPODA												
Pleurogonium sp. nov. B									1			
Munnogonium spp.												1
Munnopsurus sp. nov.					1							
ARTHROPODA: GAMMARIDEA												
Rhacotropis sp.											2	
Synchelidium shoemakeri	3		3	3	5		1		2	3	1	1
Synchelidium sp.									1			
Oedoicerotidae indet.						1						1
Westwoodilla caecala			9		2	1			2	2		1
Heterophoxus oculata	37	5	3		1	1		4				
Paraphoxus sp.												1
Paraphoxus oculatus					1							
Foxiphalus obtusidens				1								
Foxiphalus sp.						2	1		1			
Grandifoxus sp.				2		2	11		9		2	2
Harpinia sp.		16	1		3	2					2	
Lysianassidae indet.		1	1		1							
Lepidepecreum sp.	2											

Appendix 4 (cont.)

	B4		C5		D1		D2		D3		D4	
	A	B	A	B	A	B	A	B	A	B	A	B
Anonyx sp.			1		1		2					1
Orchomene sp.	2			1	1							
Pachynus barnardi				3		5	1	2			6	
Pachynus sp.			2				1			1		2
Opisa tridentata			1	1		1	2					1
Hippoinedon coluabianus			2				1					
Syrrhoe longifrons			3		8	2	1	1	1			
Tyron sp.						1						
Niccipe timida Bruzelius			2									
Guernea? reduncans (Barnard)						1						
Ampelisca careyi (adult)	31	5	18	29	10	15	14	15	13		5	4
Ampelisca careyi (juv.)											8	
Ampelisca brensiaulata						1				16		
Ampelisca agassizi						2	1		1	1		1
Ampelisca hancocki							1				1	
Byblis sp. (aale)										1		
Protomedia predens	31	11	9				9			1		
Protomedia sp.	3			3		5	5		5		5	
Photis macinerneyi (male)										1		
Photis macinerneyi (female)				5		2				1	8	
Photis brevipes	2		13		1				4			
Photis sp.								2			2	3
Photis fishmanni											1	
Podoceridae indet.												2
Stenothoidae indet.			5			1		6	5	2	5	4
Plenstidae indet.						1					5	
ARTHROPODA: EUPHAUSICEA												
Euphausia pacifica	1											
Euphausiacea indet.							1				2	
ARTHROPODA: DECAPODA												
Neocrangon communis		1									1	
Spirontocaris lamellicornis						1						
ECHINODERMATA: OPHIUROIDEA												
Ophiurida	1		11	16	1		2	3			1	
Ophiura sp.	1	1	2		3	1			1	1	10	
Ophiura sarsi				1	1							
Amphiuridae					2	6						
Amphioplus sp.			1									
Amphioplus strongyloplax	1		2	4	10	7	4	2		3		1
ECHINODERMATA: HOLOTHUROIDEA		1		1	1							
Pentamera sp.								1				

Appendix 5. Relative abundance of epifaunal organisms taken in sleds and trawls during Cruise 1.

INTERPRETIVE NOTES

1. Data are from Dobrocky Seatech's Appendix E (O'Connell and 2 from Appendix E are here merged into one. Misidentifications have been corrected and the nomenclature has been brought up to date.

2. Numbers in this table indicate relative (order-of-magnitude) abundance. O'Connel et al. never defined the criteria they used to separate one abundance class from another.

3. In the column headings, S= epibenthic sled, and T=Agassiz trawl. The numbering of sampling stations is the same as in Figure 1.

4. Data from trawl and sled samples are not strictly comparable, because of differing beam dimensions and mesh sizes. Generally, the epibenthic sled was used over silt substrates, and the Agassiz trawl was used over sand substrates.

Appendix 5. Relative abundance of epifaunal organisms taken in sleds and trawls during Cruise 1.

	A1 S	A1 T	A2 S	A4 S	A5 T	B1 S	B2 S	B3 S	C1 S	C2 S	C4 S	C4 T	D1 T	D2 T
POLYPLACOPHORA						1				1			1	
MOLLUSCA: APLACOPHORA														
Chaetodermata argenteum			3							4				
MOLLUSCA:GASTROPODA														
Bathybembix cidaris													1	
Margarites lirulatus													1	
Solariella varicosa	4	1	1			2	4	1	3	1	4			
Bittium vancouverense							1						1	
Epitonium spp.	1	1	1			1	1			1				
Balcis rutila	1								1					
Crepidula lingulata													1	
Polinices pallidus					1					1				
Boroetrophon dalli	2													
Colus halli										1				
Mohnia frielei	1		1		1	1	1	1	1					
Plicifusus brunneus	2		1				2	2	2		2			
Nassarius mendicus	1	1												
Amphissa columbiana													1	
Nitidella gouldi	4	2	1		1	4		2	2	1	2			
Admete couthouyi			1				2		2	1				
Antiplanes voyi			1		1			1	1	1				
Ophiodermella incisa	1					1	1				1			
Odostomia spp.	2		1			2		1			2			
Turbonilla aurantia	1					1	1							
Actiocina culcitella	1					2	2			1	1			
Cylichna attonsa	1	1	1		1	1	1	1			1			
Volvulella cylindrica	1						1							
MOLLUSCA: BIVALVIA														
Nucula belloti	1					1				1				
Nuculana extenuata						2	3	1	1	1	1			
Yoldia scissurata + Y. martyria	4	4	4		3	4	4	3		4	4			
-thraciaeformis	3		3		2	3	3	3	2	3	4			
Pecten caurinus						1	1	1	1					
Lucina tenuisculpta	1													
Thyasira cygnus						1								
Cyclocardia ventricosa	3	1	1			3	3	2	1	2	2			
Nemocardium centifilosum	1					1	1				1		1	
Macoma carlottensis			3			2	3	2	3	4	3			
-eliminata	1				1	1	1							
Compsomyax subdiaphana	2					2	1	1	2		1			
Lyonsia sp.	1					1			1					

| | A1 S | A1 T | A2 S | A4 S | A5 T | B1 S | B2 S | B3 S | C1 S | C2 S | C4 S | C4 T | D1 T | D2 T |

Appendix 5 (cont.)

	A1 S	A1 T	A2 S	A4 S	A5 T	B1 S	B2 S	B3 S	C1 S	C2 S	C4 S	C4 T	D1 T	D2 T
Pandora cf. filosa	2					3	2	2	2	3	1			
-grandis	1	1	1		1			1						
Cardiomya sp.	2	1	1		1	3	4	1	1	1	1			
MOLLUSCA: SCAPHOPODA														
Cadulidae indet.	2	3	3		1	4	4	4	4	4	2			
Dentalidae indet.	2	1	1			2	2	2			2			
POLYCHAETA														
Leitoscoloplos pugettensis		1						1		1				
Laonice cirrata			1		2	1	1	1		1				
Paraprionospio pinnata		1	1	1				1		1				
Prionospio steenstrupi			1				1	1		1				
Spionidae sp.											1			
Trochaeta multisetosa			2		1									
Tharyx sp.			1											
Cirratulidae sp.			1											
Asychis similis					1									
-sp.		1												
Euclymeninae sp.		1												
Maldane glebifex		1	1											
-sp.		1	1											
Praxillella gracilis		1					1							
-sp.	1	1	1	1	2		1							
Travisia pupa			1		1									
Aphrodita japonica		1		1			1						1	1
Antinoella macrolepida						1		1	1					
Arctonoe pulchra		1												
Gattyana treadwelli					1					1				
Harmothoe lunulata			1			1								
-sp.										1				
Lepidasthenia berkeleyae		1												
Lepidonotus squamatus											1			
Tenonia kitaspensis		1												
Polynoidae indet.						1		1						
Pholoides aspera													1	
Eulalia levicornuta		1	1				1	1						
Phyllodocidae sp.		1						1						
Exogone sp.				1			1	1						
Cheilonereis cyclurus													1	
Nephtys assignis		1												
-ferruginea				1				1						
-punctata		1			1									
-sp.		1	1			1		1	1					
Glycera capitata		1	1	1	1	1				1				
Glycinde armigera		1			1		1	1		1	1			

	A1 S	A1 T	A2 S	A4 S	A5 T	B1 S	B2 S	B3 S	C1 S	C2 S	C4 S	C4 T	D1 T	D2 T

Appendix 5 (cont.)

	A1 S	A1 T	A2 S	A4 S	A5 T	B1 S	B2 S	B3 S	C1 S	C2 S	C4 S	C4 T	D1 T	D2 T
Goniada brunnea		1												
Onuphis iridescens		1	1	1	2			1		2				
Lumbrineris bicirrata		1		1	1		1	1		1				
-cruzensis			1	1			1	1						
-luti		1	1	1										
Ninoe gemmea			1	1	1			1						
Paraninoe simpla		1	1		1									
Drilonereis sp.				1				1						
Sternaspis scutata		3	3	3	2	4	4	4	2	2				
Myriochele oculata		1	1	2		1		2	1	2				
Owenia fusiformis							1							
Brada sachalina			1		1		1			1				
-villosa			1											
Pectinaria californiensis			2	2	2	1	3	2	1	2				
Amage anops		1		1		1	1							
Ampharete acutifrons		1	2	1		1	1	1	1	2		1		
-finmarchia						1		1		1				
Amphicteis mucronata		1	2	1	3	1		1		1				
-scaphobranchiata		1	1	1	2	1	1	1	1	1				
-sp.						1								
Melinna cristata		1			1		1	1	1	1				
Samytha cf. californiensis								1		1				
Ampharetidae sp.						1		1						
Pista brevibranchiata		3	1	1	2	1	1	1	1	1				
-cristata		4	2	2	1	1		1		1				
-sp.		1												
Terebellides stroemi		2	3	1	2	3	2	3	1	2				
Chone sp.		1			1									
SIPUNCULA														
Goldfingiidae			1											
CRUSTACEA: MYSIDACEA			1	1		1	1	1	1	1				1
Disacanthomysis dybowskii							1	1						
Holmsiella affinis										1				
Inusitatomysis insolita								1	1					
Meterythrops robusta										2				
Neomysis ?kadiakensis										1				
Pacificanthomysis nephropthalma				1		2	1	2	1	1				2
Pseudomma truncatum				1				1		2				
Stilomysis grandis									1	1				
CRUSTACEA: CUMACEA	1		1	1		1	1	1		1	1			
CRUSTACEA: ISOPODA	1		1	1	1		1	1	1			1		

	A1 S	A1 T	A2 S	A4 S	A5 T	B1 S	B2 S	B3 S	C1 S	C2 S	C4 S	C4 T	D1 T	D2 T

Appendix 5 (cont.)

	A1 S	A1 T	A2 S	A4 S	A5 T	B1 S	B2 S	B3 S	C1 S	C2 S	C4 S	C4 T	D1 T	D2 T
CRUSTACEA: AMPHIPODA	3			1	1	1	1	1	1	1	1			
CRUSTACEA: EUPHAUSIACEA							1		1					
Thysanoessa spinifera							2							
CRUSTACEA: DECAPODA														
Pandalus jordani	1		1	1		2	1	1	2	1	1	1		1
-platyceros												1		
-stenolepis												1	1	
Eualus avinus	2		3	3	1	4	2	2	2	2	3			
-berkeleyorum	1					1	1	1	1			1		
-pusiolus								1						
-sp.			1											
Spirontocaris holmesi	1		1	1		2	1	1	1	1	1			
-lamellicornis						1								1
-sp.			1											
Argis alaskensis														1
Crangon alaskensis								1						
Metacrangon munita									1	1				
-spinosissima	1					1								
Neocrangon communis	4		1	2		4	4	2	3	2	1	1	2	3
-cf. resima	1			1		3	2	1	1	1		1	1	2
Paracrangon echinata													1	
Pagurus alskensis														1
-ochotensis								1						
-sp.			1	1		1							1	
Paguristes turgidus												1		
ECHINODERMATA: OPHIUROIDEA														
Ophiura luetkeni	1													
-sarsi			1	1										
-sp.	1								1	1	1	1	1	1
Amphioplus macraspis		1			1			1		1				
-strongyloplax	1	1	2	1	2			1		1				
Gorgonocephalus eucnemis													1	2
ECHINODERMATA: ASTEROIDEA														
Luidia foliolata	2			1		1							1	1
Ctenodiscus crispatus										1				
Mediaster aequalis	1													
Hippasteria spinosa	1													
Crossaster papposus												1	1	
Stylasterias forreri		1				1					1	1	1	
ECHINODERMATA: ECHINOIDEA														
Allocentrotus fragilis			1			1						2	1	

| | A1 S | A1 T | A2 S | A4 S | A5 T | B1 S | B2 S | B3 S | C1 S | C2 S | C4 S | C4 T | D1 T | D2 T |

Appendix 5 (cont.)

	A1 S	A1 T	A2 S	A4 S	A5 T	B1 S	B2 S	B3 S	C1 S	C2 S	C4 S	C4 T	D1 T	D2 T
Strongylocentrotus pallidus												2	1	
Brisaster latifrons	1	2			4	1	1	1		2				
ECHINODERMATA: HOLOTHUROIDEA														
Parastichopus sp.								1					2	
Molpadia intermedia		1		1	2									
Pentamera populifera	2			1				1						
-pseudocalcigera	2	2	1	2	1		1	2	1	2				
-sp.	1			1					1					
CHONDRICHTHYES: ELASMOBRACHII														
Raja kincaidi													1	
CHONDRICTHYES: HOLOCEPHALI														
Hydrolagus colliei			1						1			1		
OSTEICHTHYES: GADIFORMES														
Theragra chalcogramma								1						
Aprodon cortezianus	1							1						
Lycodes brevipes	1					1	1	1	1					
-diapterus								1	1					
Lycodopsis pacifica								1				1		
OSTEICHTHYES: PERCIFORMES														
Ronquilus jordani												1	1	
Lumpenella longirostris								1						
Poroclinus rothrocki	1		1			1	1	1	1					
OSTEICHTHYES: SCORPAENIFORMES														
Sebastes elongatus													1	
Dasycottus setiger								1						
Icelinus filamentosus											1			
Icelus spiniger						1		1						
Radulinus asprellus	1								1		1		1	1
Agonus acispenserinus								1						
Asterotheca alascana			1											1
Bathyagonus nigripinnis								1						
Xeneremtus leiops											1			
Liparis sp.	1													
OSTEICHTHYES: PLEURONECTIFORMES														
Citharichthys stigmaeus	1						1							
Glyptocephalus zachirus						1					1			1
Lyopsetta exilis						1					1		1	
Microstomus pacificus											1		1	

	A1 S	A1 T	A2 S	A4 S	A5 T	B1 S	B2 S	B3 S	C1 S	C2 S	C4 S	C4 T	D1 T	D2 T

Appendix 6. Relative abundance of epifaunal organisms taken in sleds and trawls during Cruise 2.

INTERPRETIVE NOTES

1. Data are from Dobrocky Seatech's Appendix E (O'Connell and 2 from Appendix E are here merged into one. Misidentifications have been corrected and the nomenclature has been brought up to date.

2. Numbers in this table indicate relative (order-of-magnitude) abundance. O'Connel et al. never defined the criteria they used to separate one abundance class from another.

3. In the column headings, S= epibenthic sled, and T=Agassiz trawl. The numbering of sampling stations is the same as in Figure 1.

4. Data from trawl and sled samples are not strictly comparable, because of differing beam dimensions and mesh sizes. Generally, the epibenthic sled was used over silt substrates, and the Agassiz trawl was used over sand substrates.

Appendix 6. Relative abundance of epifaunal organisms taken in sleds and trawls during Cruise 2.

	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T
POLYPLACOPHORA							1					1			
MOLLUSCA:GASTROPODA															
Bathybembix cidaris			1												
Margarites lirulatus							1	3			2				
Solariella varicosa	4	2	1	1	2	1	1	3			1				1
Bittium vancouverense						1	1	3	1						
Epitonium spp.	2		1				1	1							
Eulima rutila	1														
Crepidula lingulata												1			
Polinices pallidus	2	1	1	2	1	1	1	2	2		2	1			1
Boreotrophon dalli							1	2							1
Cryptogemma adrastia			1					1							
Mohnia frielei	1		1	1		1			1			1			
Plicifusus brunneus	2		1	1	1	1	1	1	1			1			
Nassarius mendicus	1														
Amphissa columbiana							1					1			
Nitidella gouldi	3	1	1	4	2	1	2	2	1			1			1
Admete couthouyi					1			2	1						
Antiplanes voyi					1	1	1	1				1			1
Ophiodermella spp.	1	2		1		1	1	2							
Odostomia spp.	2			1			1	1							
Turbonilla aurantia	1							1							
Actiocina culcitella	2			1	1	1		1	1						1
Cylichna attonsa	1	1	1		1	1									
Gastropteron pacificum	1	2													
Volvulella cylindrica	1				1				1						
BIVALVIA															
Nucula belloti	1							1							
Nuculana spp.			1	1	1	1	1	2	2						
Yoldia scissurata + Y. martyria	4	4	3	3	4	3	3		3						
-thraciaeformis	3	3	3	2	3		1		2						
Crenella decussata								1							
Musculista senhousei									3						1
Musculus niger								2							
Pecten caurinus							1								
Thyasira cygnus								2							
Cyclocardia ventricosa	2	1	1	1	2	1	2	2	1				1	1	1
Nemocardium centifilosum	2	1			1		2	3			1	1			1
Macoma carlottensis	1	1			1	1	1	1	1						
-eliminata	1			2	2	1	1	3	1						
Compsomyax subdiaphana	2	1	1	1	2	1		2							

	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T

Appendix 6 (cont.)

	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T
Lyonsia californica								1							
Pandora filosa	1		1	2	2	1	1	2	2				1		1
-grandis		1			1		1						1		
Cardiomya spp.	2	1		1	1	1		2	1						
MOLLUSCA: SCAPHOPODA															
Cadulidae indet.	4	2	2	3	4	3	1	1	4						
Dentalidae indet.	3	1		3	2	2	1	1	1						
MOLLUSCA:APLACOPHORA															
Chaetoderma argentum		4				9									
Limifossa cf. talpoideus									6						
POLYCHAETA															
Leitoscoloplos pugettensis									1						
Aricidea nonsuecica									1						
Laonice cirrata		1	1	1	1	1		1	2						
Paraprionospio pinnata		1	1		1	1	1		1						
Prionospio steenstrupi					1	1									
Chaetozone acuta								1							
Tharyx sp.								1							
Cirratulidae sp.				1				1							
Heteromastus sp.									1						
Asychis nr. disparidentata			1												
-similis			1												
-sp.			1	1											
Euclymeninae sp.			1	1											
Maldane glebifex			1				1								
-sp.			1					1	1						
Notoproctus pacificus			1	1				1				1			1
-sp.									1						
Praxillella gracilis			1	1					1						
-sp.	1	1	1	1	1	1		1							
Ophelina acuminata		1	1	1	1										
Travisia pupa		1													
Aphrodita japonica	1		1		1	1		1	1			1	1		
Arctonoe vittata															1
Eunoe sp.								1							
Gattyana ciliata	1	1			1		1	1				1			
-treadwelli		1	1												
Harmothoe lunulata			1					1	1						
-sp.		1	1												
Lepidasthenia berkeleyae						1									
Lepidonotus squamatus										1					
Polynoidae sp.					1				1						
Pholoides aspera							1					1			

	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T

Appendix 6 (cont.)

	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T
Eulalia levicornuta	1	1		1	1	1	1	1	1						
Phyllodoce groenlandica	1						1								
Cheilonereis cyclurus							1						1		1
Nephtys ferruginea		1			1				1						
-punctata			1	1		1			1						
-sp.					1										
Glycera capitata	1	1	1	1		1		1	1						
Glycinde armigera		1	1	1	1	1	1		2						
Goniada brunnea		1													
Onuphis iridescens	1	2	1	2	1	1			1						
Lumbrineris bicirrata			1	1	1	1			1						
-cruzensis					1	1			1						
-luti			1		1				1						
Ninoe gemmea			1	1					1						
Sternaspis scutata	2	2	2	4	4	4	2	2	2						
Myriochele oculata		4	2		1				1						
Owenia fusiformis								1							
Brada sachalina	1	1	1		1				1						
-villosa								1							
Sabellaria cementarium												1			
Pectinaria californiensis	2	1	1	1	4	2	1	2	2						
Amage anops		1				1									
Ampharete acutifrons		1	1	1	2				1						
-finmarchia		1		1					1			1			
Amphicteis mucronata		2	2	1	1	1			1						
-scaphobranchiata		2	1	1	1	2	1	1	1						
Melinna cristata		1	1		2	1		1	2						
Samytha cf. californiensis								1	1						
Artacama coniferi		1	1		1				1						
Pista brevibranchiata	1	1	1	1	1	1	1		1			1			
-cristata	2	2	1	2	2	2	1	1	1						
-moorei		1							1						
Terebellidae sp.						1									
Terebellides stroemi		2	1	2	3	1		2	2						
Chone sp.								1							
Euchone arenae								1							
Crucigera nr. irregularis						1									
CRUSTACEA: MYSIDACEA															
Disacanthomysis dybowskii														1	
CRUSTACEA: ISOPODA														1	
CRUSTACEA: AMPHIPODA	1			1	1							1	1		

	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T

Appendix 6 (cont.)

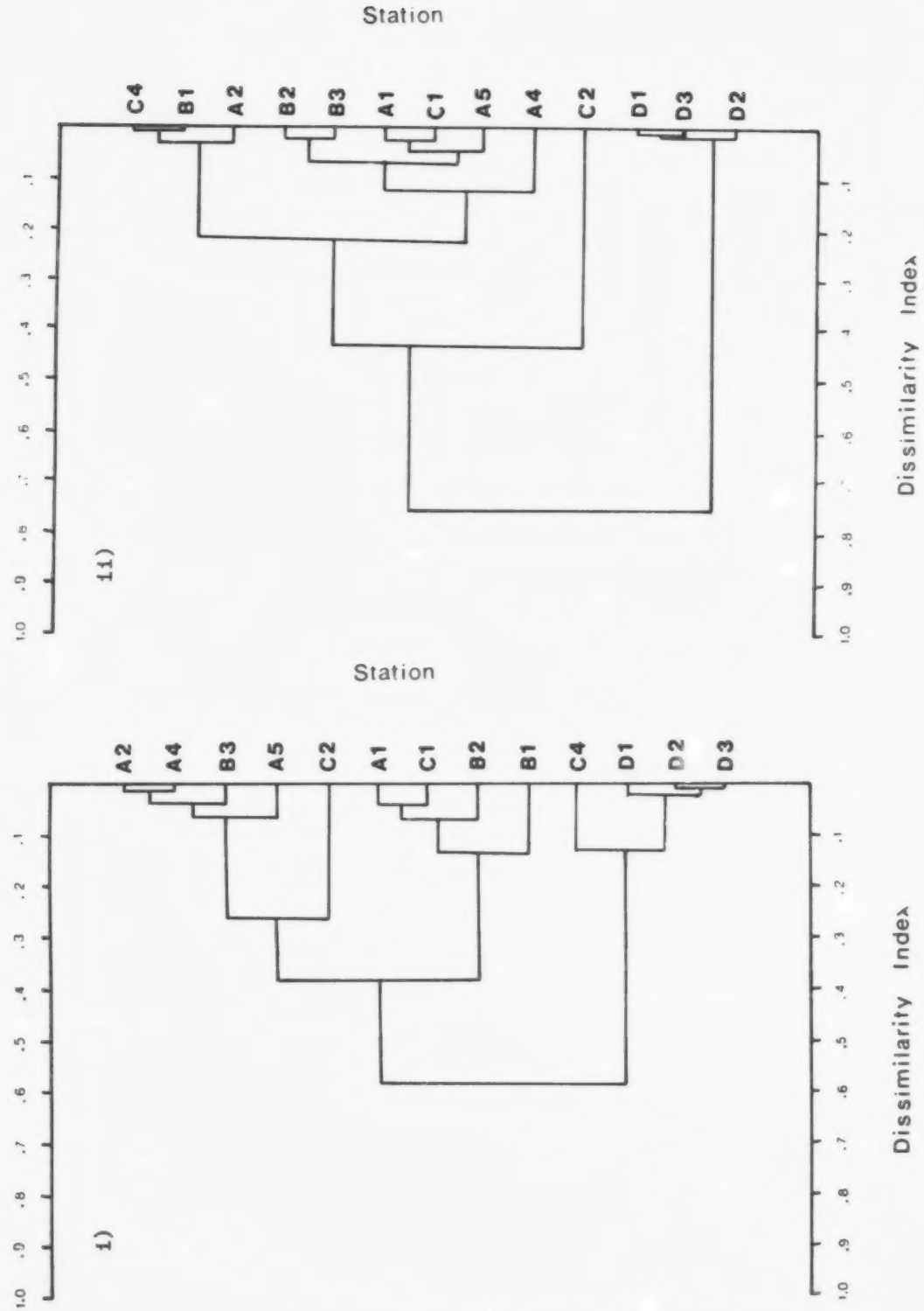
	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T
CRUSTACEA: EUPHAUSIACEA															
Euphausia pacifica												2	1		
Thysanoessa spinifera												1	1		
CRUSTACEA: DECAPODA															
Pandalus jordani	1	1		1	1			3		2	4	2	1	2	5
-stenolepis		2						3				1			
Eualus avinus	3	4	4	1	1			4				1			
-lineatus								1							
-pusiolus								1							
-sp.								2		1	1	1			
Heptacarpus decorus								1		1	1	1			
-sp.								1							
Spirontocaris arcuata								1							
-holmesi	3	2	1	1	1			1		1	1	1	1	1	1
-lamellicornis	1	1						1				1	1		1
-truncata								1							
-sp.								1							
Argis alaskensis												1	1	1	1
Metacrangon munita								1							
Neocrangon communis	2	1	1		1			3		1	1	4	4	4	4
-resima	1	1			1			1		1	1	3	3	2	3
Paracrangon echinata												1			
Paguristes turgidus												1			
Pagurus aleuticus										1	1		1	1	1
-confragosus										1	1		1		
-ochotensis								1			1		1		
-setosus												1			
-sp.					1							1			
Lopholithodes foraminatus														1	
Munida quadrispina								1		1					
Chlorilia longipes			1					1							
Oregonia gracilis								1			1				
ECHINODERMATA: ASTEROIDEA															
Luidia foliolata								1				1	1	1	
Hippasteria spinosa											1	1			1
Solaster endeca												1			
Crossaster papposus												1			
Stylasterias forreri							1				1				
ECHINODERMATA: OPHIUROIDEA															
Ophiura sarsi							2				2	2	3	2	3
Ophiura luetkeni											2		3	2	

	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T

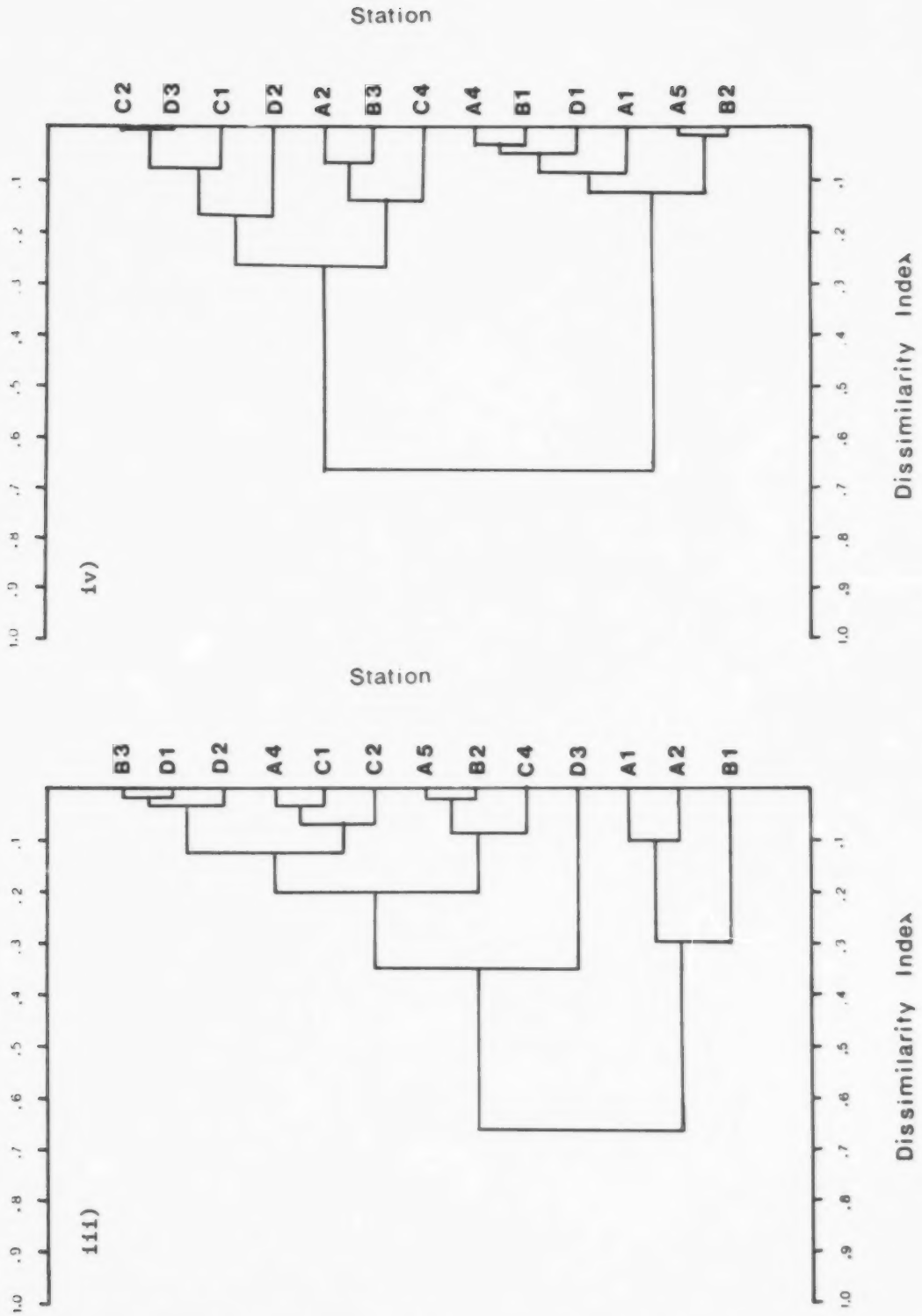
Appendix 6 (cont.)

	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T
ECHINODERMATA: ECHINOIDEA															
Allocentrotus fragilis							3	1		1	1	2	2	1	1
Strongylocentrotus pallidus											1	2			
Brisaster latifrons	2	2	2	1	2	2	1		1						
ECHINODERMATA: HOLOTHUROIDEA															
Pentamera pseudocalcigera		1	1	2	2	2			2			1			1
Parastichopus sp.												2			
Molpadia intermedia		1	1			1									
CHONDRICTHYES: ELSMOBRACHII															
Raja kincaidi											1				1
-rhina													1		
CHONDRICTHYES: HOLOCEPHALI															
Hydrolagus colliei	1						1	1				1			1
OSTEICHTHYES: GADIFORMES															
Merluccius productus															1
Lycodes diapterus	1											1			
Lycodopsis pacificus													1		
OSTEICHTHYES: PERCIFORMES															
Ronquilus jordani												1			
Poroclinus rothrocki	1				1		1	1							
OSTEICHTHYES: SCORPAENIFORMES															
Sebastes emphaeus										1					
Icelinus filamentosus												1			
Radulinus asprellus							1				1	1	2	1	2
Asterotheca alascana	1						1			1					1
-infraspinata													1		1
-pentacanthus										1					
Liparis sp.	1						1							1	
OSTEICHTHYES: PLEURONECTIFORMES															
Eopsetta jordani												1			
Glyptocephalus zachirus											1				
Hippoglossoides elassodon												1			
Lyopsetta exilis							1			1	1		1		1
Microstomus pacificus												1			

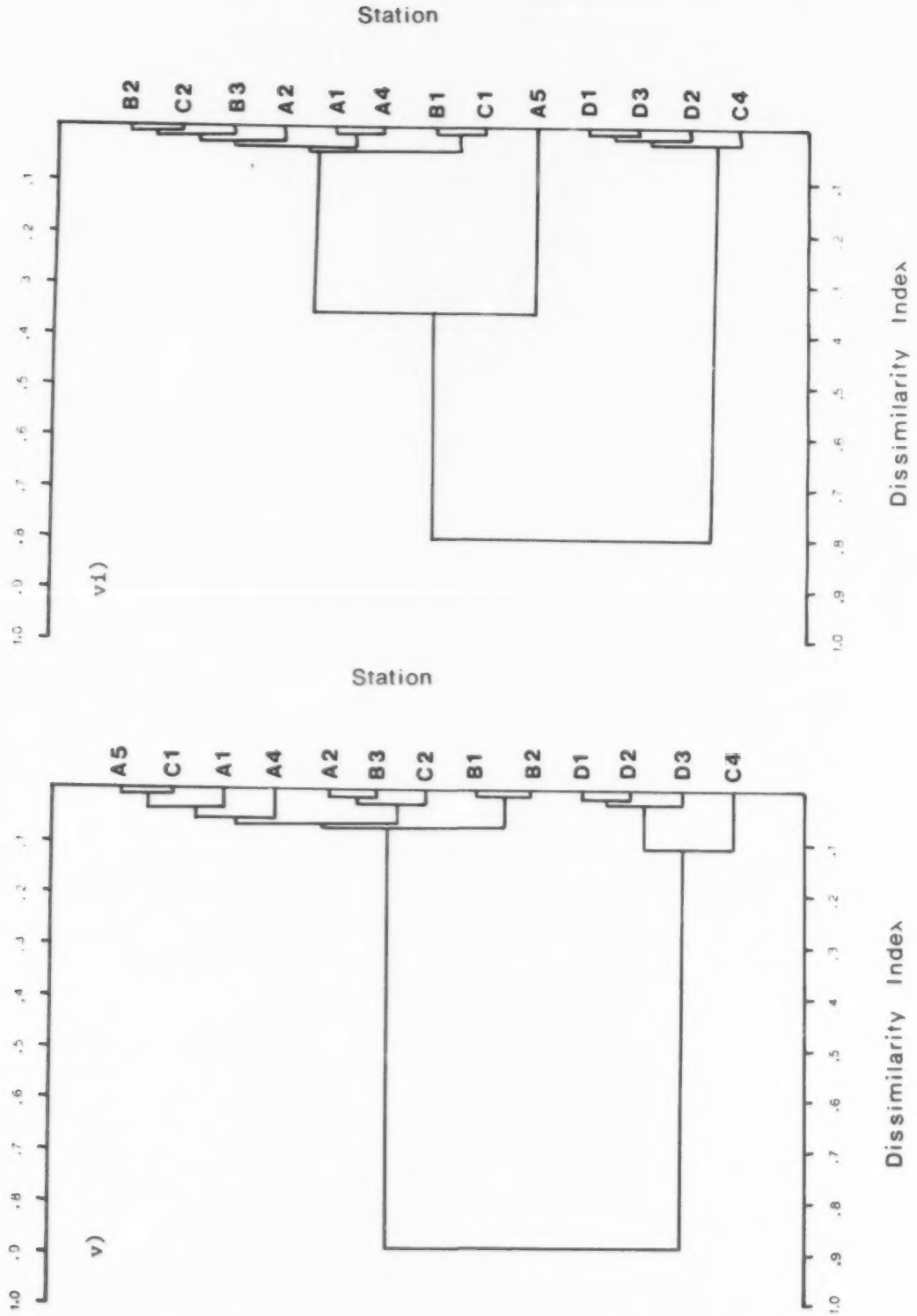
	A1 S	A2 S	A5 S	B1 S	B2 S	B3 S	B4 S	C1 S	C2 S	C4 T	C5 T	D1 T	D2 T	D3 T	D4 T



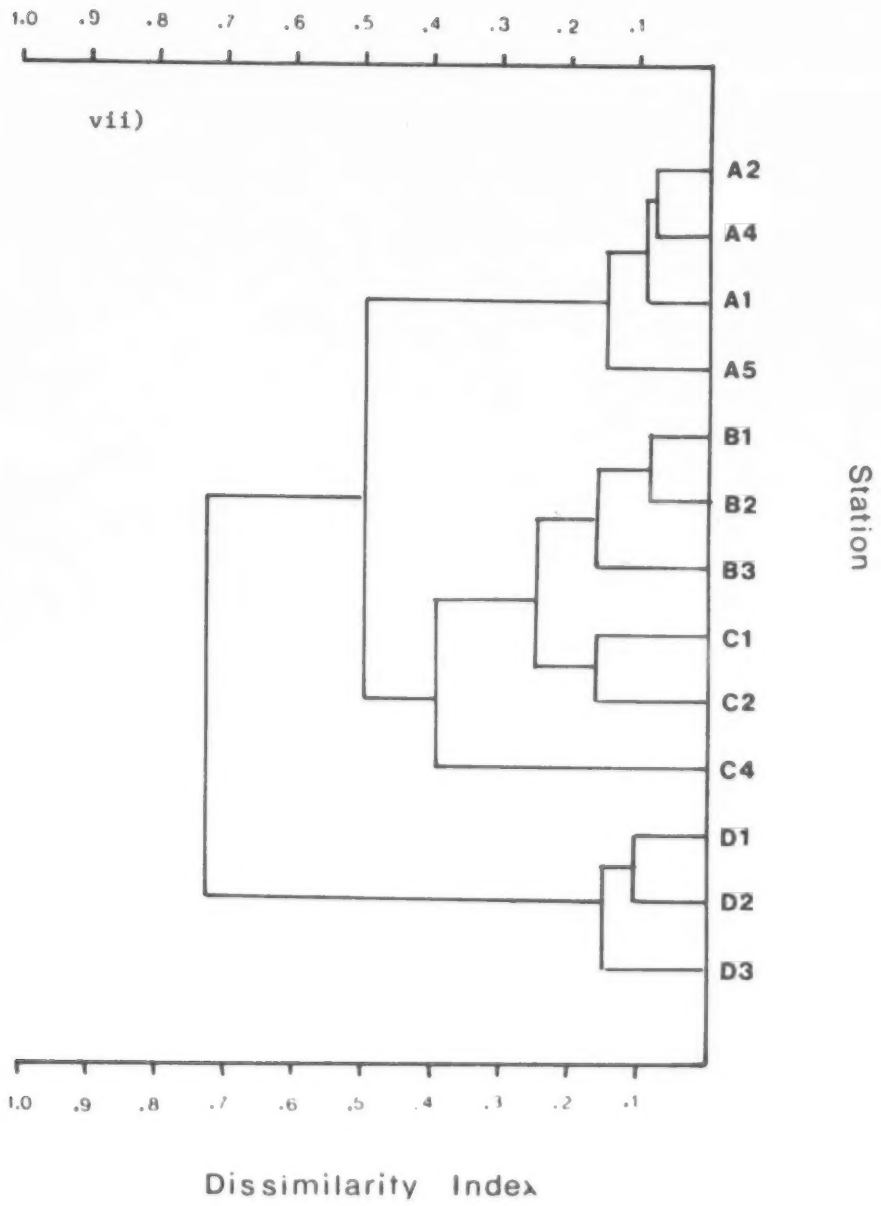
Appendix 7. Cluster dendrograms of reference trees: i) carbon content of sediment for cruise 1, ii) carbon content of sediment for cruise 2.


Station
C2 D3 C1 D2 A2 B3 C4 A4 B1 D1 A1 A5 B2
iv)
Dissimilarity Index
Station
B3 D1 D2 A4 C1 C2 A5 B2 C4 D3 A1 A2 B1
iii)
Dissimilarity Index

Appendix 7. (continued) iii) chlorophyl-a content of sediment for cruise 1, iv) chlorophyl-a content of sediment for cruise 2.


Station
B2 C2 B3 A2 A1 A4 B1 C1 A5 D1 D3 D2 C4
vi)
Dissimilarity Index
Station
A5 C1 A1 A4 A2 B3 C2 B1 B2 D1 D2 D3 C4
v)
Dissimilarity Index

Appendix 7. (continued) v) mean sediment particle size for cruise 1, vi) mean sediment particle size for cruise 2.



Appendix 7. (continued) vii) latitude/longitude (i.e. geographic distance between stations) for cruises 1 and 2.

Appendix 8. Fowlkes Mallows statistics for each linkage level to compare the abundance matrices for cruises 1 and 2. Null hypothesis (Ho) is that the two matrices are the same.

Linkage level	FM stat	"p"
1	1.00	1.00
2	0.50	0.96
3	0.29	0.60
4	0.37	0.52
5	0.71	0.93
6	0.74	1.00
7	0.67	0.85
8	0.45	0.10
9	0.74	0.57
10	0.69	0.36
11	1.00	1.00
12	1.00	1.00

Based on 75 simulations